15 SEPTEMBER 1961

METAL INDUSTRY

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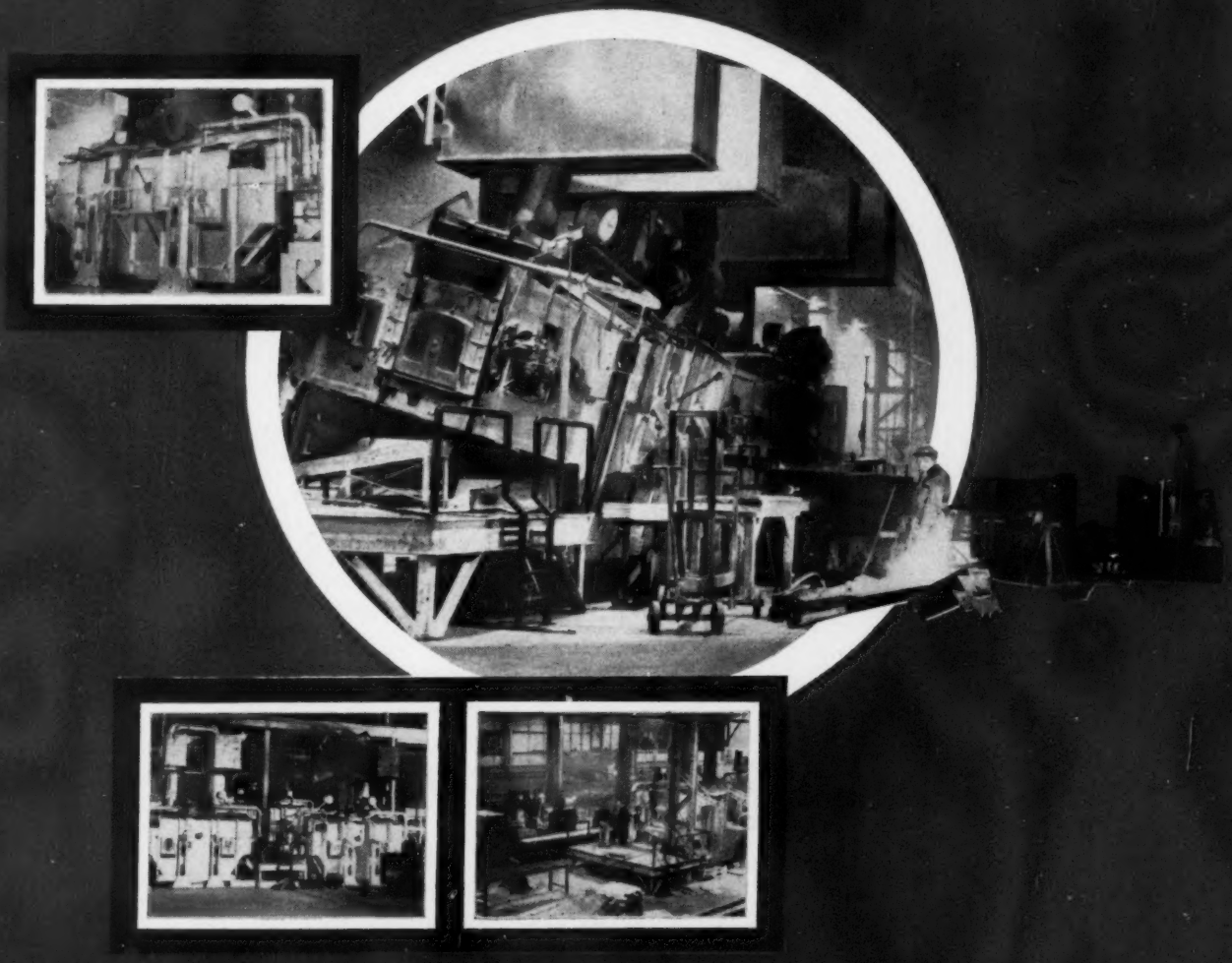
VOL 99 No 11 ONE SHILLING



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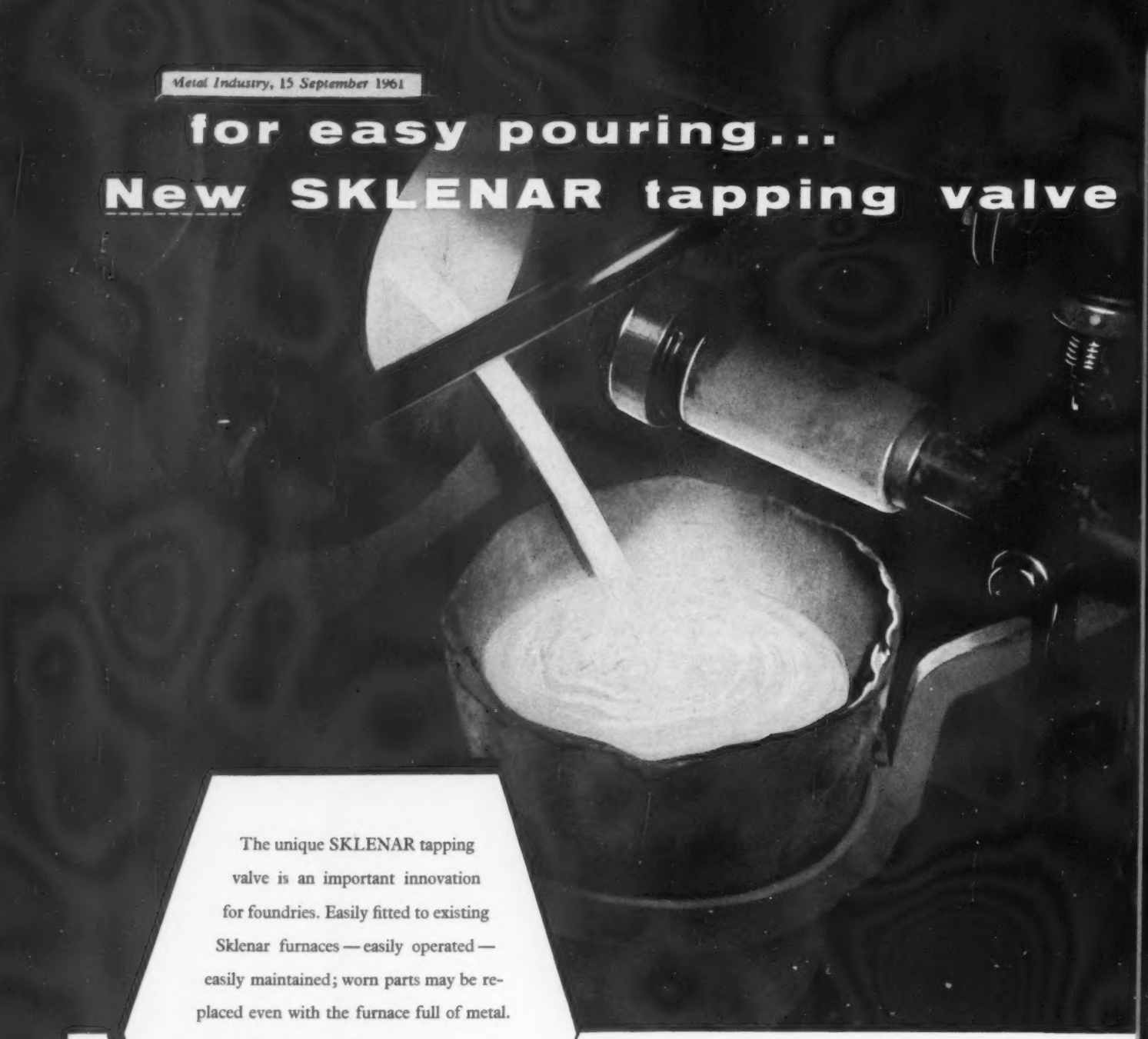

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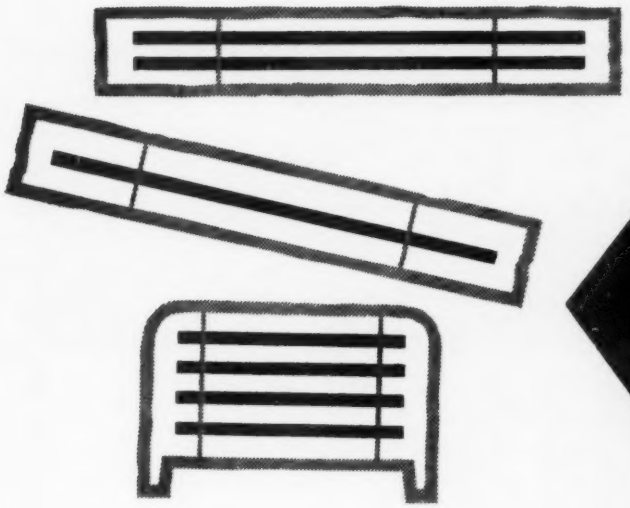

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METAL INDUSTRY

15 SEPTEMBER 1961

VOLUME 99

NUMBER 11

Service to Industry

SINCE the Department of Scientific and Industrial Research set up the National Engineering Laboratory after the second world war, a new programme of government research has been directed entirely at helping the engineering industries to improve their products and processes. From the beginning, both basic and applied research went hand in hand, so that help could be given to industry on immediate problems as well as building up a background of knowledge and experience for the future. This policy is now paying rich dividends.

First, comes the work of "greatest immediate significance to industry"—the automatic correction of errors in machine tools, the development of hydrostatic power transmissions and the cold extrusion of steel. In the last field the Laboratory is now assisting industry in the design of tooling for relatively simple cold-extruded products; further work is in progress on the production of more complicated shapes. But, although considerable interest has been shown in this development, especially from overseas, only a few British firms have introduced this process.

Falling into the same category of "results of direct industrial application" is the work on fatigue of metals at high temperatures. Present investigations include the high temperature fatigue properties of brazed joints such as are used in one of the methods of attaching rotor blades. Results show that at 800°C., with the joint in shear, the strength of a brazed joint is greater under an alternating load than a steady load. Using high-strength fillers the joint could be made as strong as, or stronger than, the parent metal. Work is also being carried out to provide information on the fatigue strength of hollow blades produced by different manufacturing processes.

Some of the results in the field of background research may even now be of direct or immediate interest, but the practical application of these studies is more likely to take place in later years. One of the most important developments is the production of new materials by using very high temperatures and pressures. Already the N.E.L. has proved its equipment by producing artificial diamonds from graphite, and this is being followed by further studies of the nickel-carbon system at high pressures. Pressures of up to 90,000 atmospheres have already been produced successfully. At later stages the Laboratory may not only be able to produce new materials, without any natural counterpart, but may also be able to synthesize materials having particular combinations of desirable properties.

Among the most important services rendered by the Laboratory to industry are the facilities for sponsored investigations and tests. The N.E.L. is particularly interested in proposals for novel investigations likely to lead to important new developments. Assistance can be provided in many ways, from accepting the full burden of the work to supervising or assisting a firm's own engineers and scientists.

Casting Titanium Shapes

By R. G. Hardy
(*Oregon Metallurgical Corporation*)

TWO problems hindering the development of a process for casting shapes were the material to be used for the melting crucible and the material to be used for the mould. Numerous oxides, carbides, sulphides, borides, nitrides, and graphite had been investigated, but all degraded the purity of the melt when used as crucibles. The first successful crucible was the water-cooled-copper tilt-pour-crucible developed at the Albany Station Bureau of Mines[1]. Machined graphite was found to be suitable for ingot moulds and shaped castings, but not until an expendable graphite ramming mix was developed[2] did the process become commercially economical.

Except for size limitations, titanium castings can now be produced within the same range of complexity and dimensional tolerances as sand castings in steel.

Electrode Preparation

When special alloys are to be cast, first titanium sponge and alloying elements are blended and pressed into briquettes, which are welded together to form consumable electrodes. These are then consumable-electrode vacuum-arc melted and poured into water-cooled copper moulds. The resulting ingots are used for consumable electrodes in the casting furnace. All metal in the final casting has been double vacuum melted.

When castings of C.P. Titanium, 6Al-4V, or 5Al-2½Sn are to be produced, gates, risers, and other foundry returns are welded to the electrode in order to recycle the material. Since gates and risers are burned from castings with an acetylene torch, they are shot blasted to remove oxides before remelting. This also removes any graphite material remaining on the parts. Purchased wrought scrap may also be welded to the electrode. The Heliarc welding process is used. In high strength alloys, welds are diluted with unalloyed titanium to prevent weld cracking.

A typical electrode is shown in Fig. 1. The welds must be large, because in addition to providing mechanical strength, they must also carry the heavy current required to melt the electrode. The electrodes are welded as symmetrically as possible to minimize arcing from the side of the electrode to the vertical wall of the crucible.

Furnace Design

The furnace design is schematically illustrated in Fig. 2. It is a tilt-pour water-cooled copper crucible, consumable-electrode vacuum arc furnace similar to the design[1] developed at the Albany Station Bureau of Mines, with the added provision for centrifuging about a vertical axis. Another furnace is available similar to this except for a horizontal centrifugal spin axis for casting tubular shapes. Statically poured castings can be made in either furnace.

For the work described here, a Kinney 220 ft³/min. pump was used with 6 in. vacuum lines. A Kinney compensating thermocouple vacuum gauge was located in the vacuum line 6 in. from the vacuum chamber. This system was capable of pumping the 100 ft³ empty furnace chamber down to 100-150 microns in approximately 20 min. When loaded with moulds, at times the furnace had to be pumped overnight to achieve 50 microns. With this system 200 microns could be maintained during melting. The vacuum would rise to as high as 1,000 microns when the moulds were poured. With the pumps blanked off, the leak rate was approximately three microns per minute.

Recently, a Consolidated Vacuum Corporation KS 4000 oil diffusion ejector pump and a second 220 ft³/min. Kinney have been added to the system. One thermocouple gauge is located in the 16 in. vacuum line 6 in. from the furnace and another in the 6 in. roughing pump line. With moulds in the furnace, approximately 15 min. are required for the mechanical pumps to pump down to 500 microns, at which time the valve to the diffusion ejector pump is opened and 10 microns are obtained in about 3 min. With this system, 50 microns can be maintained during melting.

Melting Procedure

Moulds and electrodes are assembled in the furnace and the furnace is pumped down. The crucible normally is lined with a skull from a previous heat. This skull is normally thick enough to prevent burn through without any additional starting pad; however, up to 25 per cent of the weight of the anticipated melt can be added to the crucible to avoid the expense of welding this metal to the electrode. Clean turnings can also be utilized in this manner.

The arc is struck at approximately 5,000 amp. and 30 V D.C. straight polarity (electrode negative) and normally is adjusted to 40 V, 12,000 amp. for 9 in. diameter crucibles or 42 V, 14,000 amp. for 12 in. diameter crucibles. As the electrode burns off, the electrode assembly is lowered to maintain 40-42 V. The operator maintains visual observation of the melt during melting. Melting rate is 20 lb/min.

When the desired molten volume has been obtained as judged by the length of the previously weighed electrode remaining, the electrode is rapidly withdrawn and the crucible contents are dumped into a funnel attached to the top of the down gate.

Rapid pouring is essential to prevent undesirably heavy skulls. The time between extinguishing the arc and completing the pour is 4-7 sec.

The skull from a 12 in. diameter crucible normally weighs about 20 lb. A typical skull is illustrated in Fig. 3.

Mould Materials

Moulds have been machined from C-S graphite, but now are usually produced by ramming a bonded granular mix on a pattern.

The advantage of the machined moulds is that tighter dimensional tolerances can be maintained. Also, they can be re-used several times when the casting shape is such that it does not destroy the mould by shrinking against it — in this case, the poor collapsibility of machined graphite would usually result in a cracked casting. The principal disadvantage of

Fig. 1—Typical electrode made up from scrap materials, gates, risers and foundry returns

In this article, the methods used to produce titanium castings by the consumable-electrode, vacuum-arc, skull-melting processs at the Oregon Metallurgical Corporation are discussed and examples are given of castings that have been produced by these methods. Applications and typical mechanical properties of cast titanium alloys are outlined together with details of current size and dimensional tolerance limitations.

machined graphite moulds is that the relatively high thermal conductivity of this material tends to produce cold shuts in the casting surface.

Since rammed graphite moulds are generally more economical and are less likely to cause cold shuts and hot tears, the majority of castings are produced in rammed graphite.

The bonded rammable granular graphite mix is basically that developed by Field.[2] Variations of this mix were tested[3], leading to the following standard mix: 63 per cent BB5 graphite grains, 7 per cent graphite fines, 5 per cent starch, 10 per cent foundry pitch, 8 per cent C-3 carbonaceous cement, and 7 per cent water (material per cent by weight).

The grain size distribution of the BB5 grains is shown in Fig. 4.

Properties of the mix, as measured by standard American Foundrymen's Society tests are as follows: moisture content 6·9, green permeability 190, green hardness 80, green compression 7·0, fired tensile strength 70, fired scratch hardness 65.

Used moulds can be crushed and screened to obtain reclaimed material of equivalent grain distribution. No difference in results has been observed when reclaimed material is used instead of new graphite.

The mix is prepared in a model 1-GF Carver muller. Graphite and starch are mulled dry for 2 min., pitch is added and mulled 2 min., followed by the final addition of cement and water, followed by 4 min. of mulling.

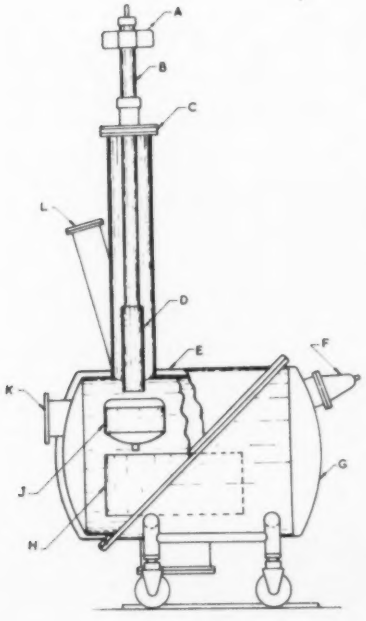
Fig. 3—Typical skull from a 12 in. diameter crucible, usually about 20 lb. in weight

Moulding

Conventional wood or metal patterns are used loose, match plate, or cope and drag. Snap flasks are used and the cope and drag are booked together to form the completed mould. Cores are made in the same manner, except that full round core boxes are used to avoid fastening the halves together.

A pneumatic bench rammer is used to produce dense moulds with uniform hardness. A jolt-squeeze moulding machine equipped with a 10 in. diameter squeeze cylinder did not provide sufficient pressure to produce a hard mould with the 100-125 lb/in^2 air pressure available. Moulds are normally rammed to an AFS mould hardness of 80.

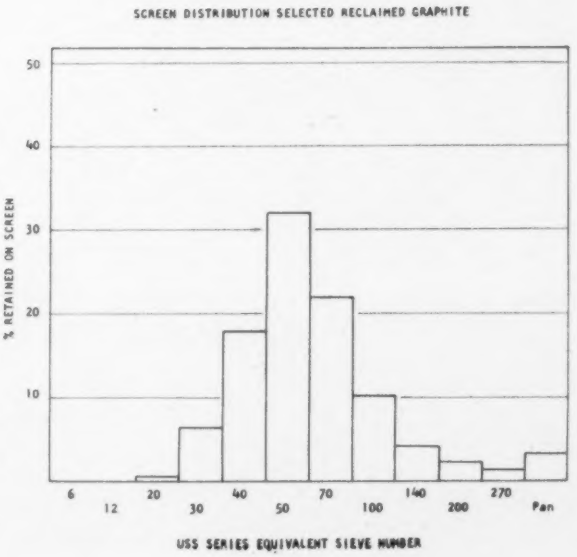
A vibrating draw machine is used to minimize dimensional variations.

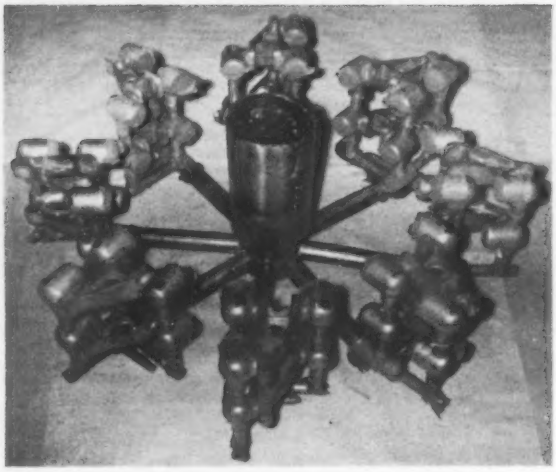


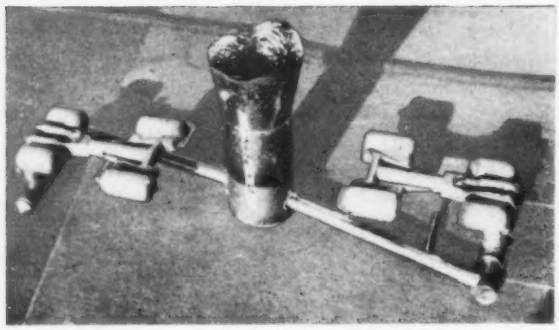
Left: Fig. 2—Sketch showing main features of consumable electrode vacuum arc furnace

A—Power lead clamping plate
B—Water cooled electrode ram
C—Micarta insulator
D—Electrode
E—Water cooled vacuum chamber
F—Light port
G—Mobile vacuum chamber
H—Mould spin tub
I—Water cooled crucible
J—Vacuum port
K—View port

Fig. 4—Grain size distribution of BB5 graphite grains which form the basis of the mould mixture







Figs. 5 and 6—Examples of the gating and risering methods used for centrifugal castings

Machined graphite is the most satisfactory material for core plates for drying, baking and firing.

The green moulds are first air dried for at least 8 hr. to obtain a slow initial moisture removal rate. When moulds are large, or because of scheduling or availability of oven space, they may air dry several days before baking. They are then baked not less than 16 hr. at 120°C. to remove moisture.

After baking, the moulds are packed in graphite powder in a stainless steel box and placed in an electrical resistance furnace at 650°C. The temperature is then raised to 870°., held for 4 hr. at temperature, removed from the furnace at that temperature and cooled in a vacuum chamber.[4] The mould parts are stored at 120°C. until assembled and placed in the vacuum furnace. Normally, about 2 hr. elapses between the time the moulds are removed from the 120°C. storing oven and the vacuum is drawn in the melting furnace.

The moulds are assembled with steel clamps and bolts.

Gating and Risering

Graphite tubing is used for gating systems.

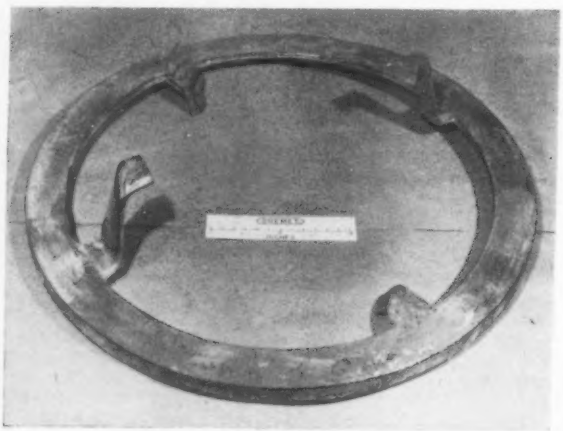
The volume of risers required is approximately the same as would be used for steel castings. Feeding distances for titanium cast in graphite are extremely limited. In flat plate sections, the distance fed sound may be as little as the section thickness[5]—beyond this distance, centre line shrinkage will occur. The limited feeding distance is probably a consequence of the relatively high thermal conductivity of the graphite mould.

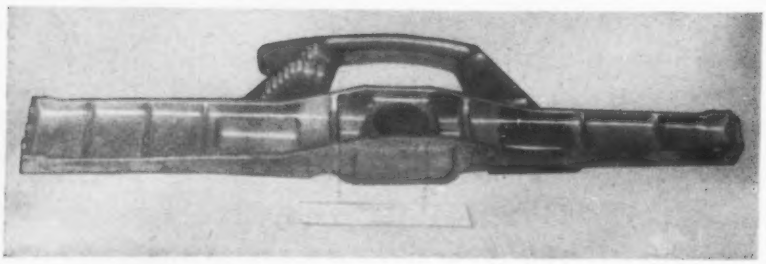
In titanium, the shrinkage tends to occur in concentrated voids[6] rather than over an extensive volume as is the case with some other metals. Consequently, the shrinkage does not extend to the surface and has never resulted in leakers. With some casting designs, advantage can be taken of the concentrated nature of the shrinkage since these areas will be completely removed by subsequent machining.

Tapered padding is the most effective means of extending feeding to distances remote from logical riser locations[6]. The most efficient padding is a parabolic contour with the greatest degree of taper at the far end of the fed portion and the degree of taper gradually decreasing to zero near the riser.

For a long time, gas porosity was more troublesome than shrinkage porosity. While at times shrinkage porosity and gas porosity may occur in conjunction with each other, at other times the two types can be clearly distinguished. True gas porosity has a perfectly spherical shape as would be expected of a gas bubble. Shrinkage porosity will be located in thermal centres which solidify later than their surroundings, while gas porosity may be found in other locations, but preferentially located in the cope side.

It was found that gas porosity could be eliminated by centrifuge casting if all portions of the casting were cast at least 10G.[6] It is not known whether the mechanism is that the G force has the effect of forcing the gas to re-dissolve because of the higher pressure or causes the gas to be more





Figs. 7 and 8—A wide variety of shapes and sizes in cast titanium has been produced, as exemplified by this ring-type component (left) and the structural member (below)

rapidly floated out to the surface. Since centrifuging is so effective, almost all castings are now centrifuge poured.

Since the centrifugal force increases the linear velocity of metal flow within the gates and mould cavity, splashing is more serious than with static pours. To prevent surface defects caused by splashing, castings must be "bottom gated" — the "bottom" of the casting being that part most remote from the vertical spin axis rather than that part closest to the earth's centre. The direction of rotation is also taken into consideration—to prevent turbulence, the gate enters at the trailing edge of the casting cavity.

The concept that "up" is toward the spin axis also applies to the riser orientation.

Examples of gating and risering of centrifuge castings are given in Figs. 5 and 6.

Size and Tolerance Limitations

The maximum overall casting dimensions applying with the present melting furnace are: length 6 ft., width 3 ft., height 2 ft.

Maximum pouring weight (including gating) is 300 lb.

Depending on their shape, because of the 3 ft. spinning radius available, larger castings may not benefit from centrifuging and may contain gas porosity.

Minimum section thickness: $\frac{3}{32}$ in. Dimensional tolerances: ±0·020 in. to 3 in. Add ±0·005 in. for each inch over 3 in. Add ±0·005 in. for dimensions measured across parting line.

Patternmakers shrinkage $\frac{3}{8}$ in/ft. Of this, $\frac{1}{8}$ in/ft. is mould shrinkage[5] and $\frac{1}{4}$ in/ft. is metal shrinkage. The finish is equal to smooth sand castings.

Machining

Titanium alloys compare with austenitic stainless steel in toughness, but do not work harden. Recommended tool angles are: back rake 3°, side rake 3°, end relief 7°, side relief 10°. Cutting speed 15 surface ft/min. using air cooling or cutting oils. Use high speed tool steels such as Rex 95.

Alloys

The metals most frequently cast are unalloyed titanium and 6Al-4V. A less frequently cast standard alloy is 5Al-2½Sn.

Under development is a higher strength alloy of approximate composition 8Zr-4Al-4Sn-2V. The best composition range for this alloy has not yet been determined.

Typical mechanical properties of these alloys are given in Table I.

Zirconium and Zircalloy castings can be produced by the same methods used for titanium.

Applications

The two areas where titanium castings are used are aircraft and corrosion resisting applications.

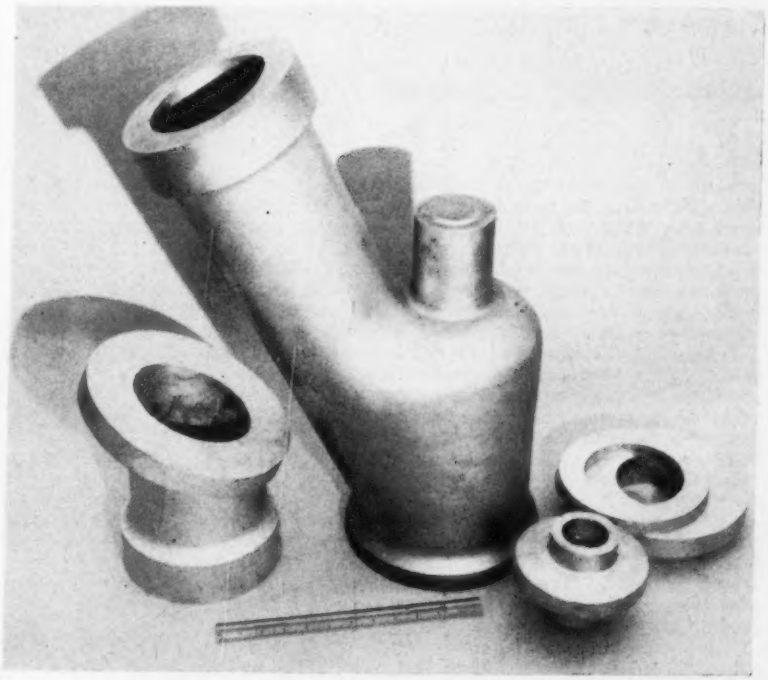
In aircraft, their elevated temperature

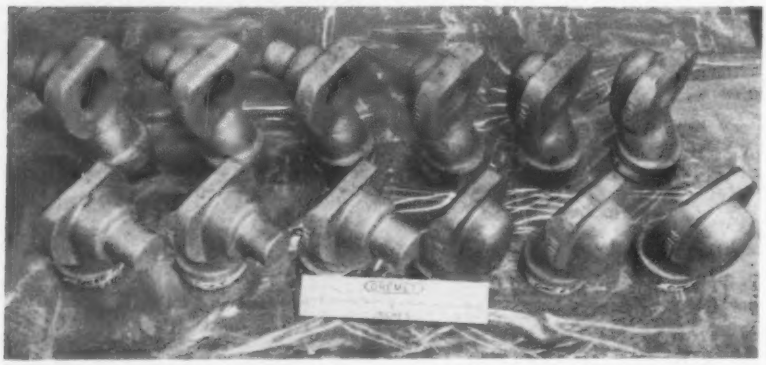
Fig. 9—Flanged valve body cast in titanium

TABLE I—MECHANICAL PROPERTIES OF CAST TITANIUM

	2 per cent YS	U.T.S.	Elong.	RA	BHN
	Kg/in²	Kg/in²	per cent	per cent	
6Al-4V	130	145	8	14	321
5Al-2½Sn	130	140	11	20	321
Unalloyed Ti	70	90	10	20	217
8Zr-4Al-4Sn-2V	140	160	8	15	311

Fig. 10—Cast titanium fittings; of especial value where corrosion-resistance is of prime importance





Figs. 11 and 12—For some applications, cast titanium brackets (above) and connections (below) have advantages over more conventional materials

strength-weight advantage is considerable. Where aircraft parts in the past have been aluminium or magnesium castings, the equivalent parts are candidates for titanium castings where temperatures have increased because of the higher speeds of newer high-performance aircraft and missiles.

Since 6Al-4V is approximately twice as strong and 60 per cent as dense as austenitic stainless steel castings, it offers weight saving possibilities where austenitic stainless steel castings are being considered.

Perhaps the most promising field for aircraft applications is in refrigeration, air conditioning, and hydraulic mechanisms since these operate in the 200°C. to 480°C. temperature range where titanium has the greatest strength/weight advantage, and these mechanisms require cast shapes.

The most promising corrosion resisting applications are sea water and brines, ferric chloride and other metallic chloride solutions, wet chlorine, sodium and potassium hypochlorite, nitric acid 0-2 per cent and 21-80 per cent concentration, chromic acid, acetic acid, hydrobromic acid, phosphoric acid to 30 per cent, all organic acids except formic and oxalic, chlorinated hydrocarbons, and fruit and tomato juices and sauces.

These are the kinds of applications where austenitic stainless steels, Monel or the ACI CN-7M Cu type are often used. In general, titanium becomes superior to these metals when temperatures increase or the protection films of the other metals fail because of erosion due to high velocities or scouring due to entrained solid particles. Good applications are impeller and other pump parts, agitators, valves, and fittings.

Some of the parts which have been cast are illustrated in Figs. 7-12.

The author wishes to express appreciation to Boeing Airplane Company and to the A.M.C. aeronautical centre L.M.B.M.B., for sponsoring much of the development on which this report is based under subcontract No. 2669900-8125 and Contract No. AF 33(600)-36450. Acknowledgment is given to Mr. Roger V. Carter, of Boeing Airplane Company, for guidance, and to Messrs. J. W. Smith and T. A. Hamm, of Oregon Metallurgical Corporation.

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Standard Specification

Safety Valves, Gauges and other Safety Fittings for Air Receivers and Compressed Air Installations. (*B.S.* 1123 : 1961). *Price* 4*s.*

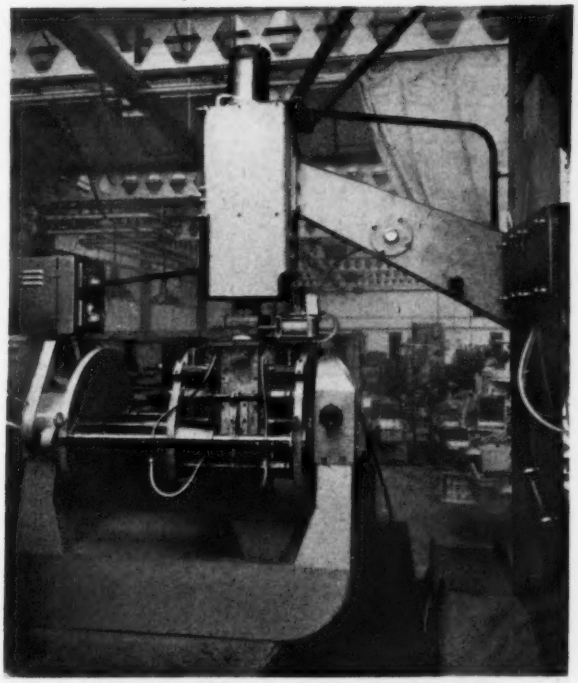
THE use of compressed air grows each year as more and more applications are found for it. To help this growth, the British Standards Institution has revised and enlarged B.S.1123, giving specifications for safety valves, gauges, and other safety fittings for air receivers and compressed air installations.

Although the main provisions of the standard remain unchanged, modifications have been made to secure co-ordination with the 1955 edition of revised B.S.759 — "Valves, Gauges, and other Safety Fittings for Application to Land Boilers and Piping Installations for and in Connection with Land Boilers". The most important of these modifications is the permissible use of safety valves having an established discharge greater than provided for by the minimum aggregate area formula.

The revision also includes a comprehensive specification covering the requirements for safety valve springs.

Copies of the above - mentioned standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Automatic Shell Moulding



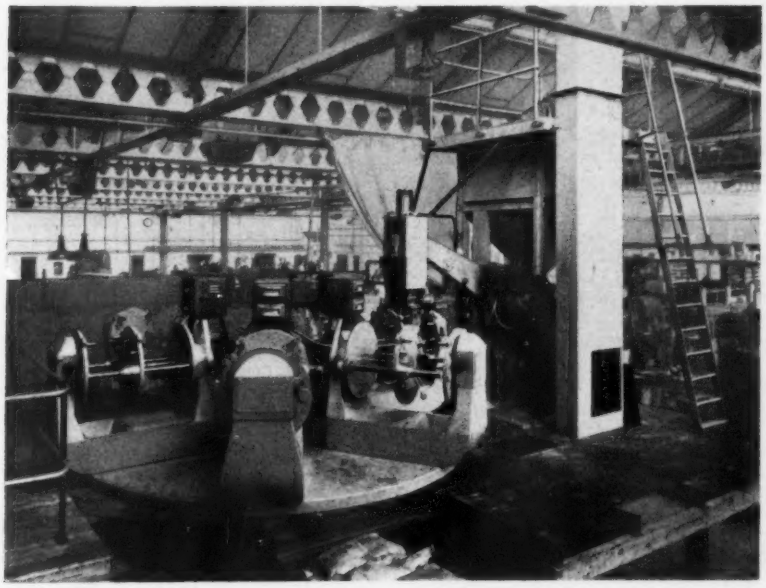
Close-up of blowing head and manipulator

A NEW six station automatic shell mould and coremaking machine, developed by Polygram Casting Co. Ltd., makes possible the production of a large output of both moulds and cores with the labour of only two men. For example, the machine will handle coreboxes up to 28 in. by 18 in. by 12 in. deep, and is capable of producing such cores at the approximate rate of 100/hr. Obviously, smaller cores can be produced from multi-impression coreboxes, at an equivalent rate, so that with six impression boxes, the rate of core production will be approximately 600 cores/hr.

The production of shell moulds is likewise extremely high. Two shells are produced at each of the six stations, and hence under normal production conditions, shells should be produced at the rate of 200/hr.

The machine consists of six manipulator stations, mounted radially, at 60° intervals, on a 12 ft. dia. turntable. The turntable is power driven by a unique indexing device, a feature of which is its innately simple but extremely rigid construction, and the fact that at all times the table is rigidly locked, both during its arcuate motion and during its dwell periods. The necessary smooth motion imparted to the table is extremely impressive, as is the accuracy of the indexing of such a large table, which is normally held to a limit of 0·004 in.

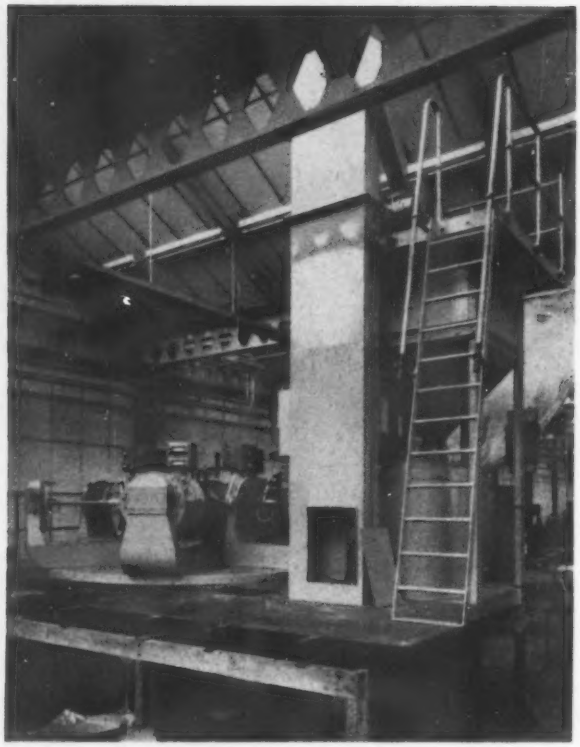
The six-station automatic shell-moulding machine



Power services, compressed air and electrical, are fed to the table through the centre bearing, and thence individually to each of the six manipulators. A total of 120 kW is available, allowing a maximum of 20 kW at each manipulator station. In service, consumption will probably be well below this figure. The pattern equipment, or corebox, is mounted between two pressure plates, the outer one being fixed, whilst the second one slides along two parallel ground guides, by means of the horizontally mounted air cylinder.

Ejection is controlled in such a way that the core is first released from the half box mounted on the fixed pressure plate, and is not ejected from the other half until the withdrawal stroke of 16 in. is completed. The ejection system incorporated on each manipulator is spring controlled but the springs are housed externally, out of the heat zone, and hence premature failure of the springs due to overheating is obviated. An electric control panel is incorporated to regulate corebox and pattern plate temperatures automatically, both halves of the corebox being individually controlled to within ±5°C., whilst the temperature of both pattern plates is similarly held to the same close tolerances.

Both moulds and cores are blown from a new blowing head specifically designed for this purpose. A feature of this blowing head is that although



Elevator for charging sand and returning excess sand to hopper

compressed air is used as the motivating agent, the sand emerging from the head is almost free of air. In this way, the turbulence normally experienced with conventional blowing heads is almost eliminated, and in many cases, it is possible to dispense with venting of coreboxes and pattern plates entirely.

In operation, each manipulator is indexed successively beneath the blowing head. The head is pneumatically clamped over the core box or pattern plate assembly and immediately fills the cavity under any desired blowing pressure. After a predetermined time the head retracts. The manipulator then inverts through 180°, to expel the excess coated sand, and can be made to rock to ensure complete extraction. The table, meanwhile, can be indexed to the next station, and then successively through stations three, four and five. As the sixth station is approached, the pressure plates of the manipulator automatically separate, actuating the ejection. An operator is stationed at this ejection point to remove the ejected shell and cores and then to depress the valve to index the table to the next station.

Excess sand is collected by a chute, at any point between the blowing point and the following station, and is collected on a rubber belt, from which it is fed into the boot of an elevator. A floor grid positioned over this rubber conveyor also allows new sand to be fed into the system. The elevator lifts the sand, and discharges it into a hopper, the sand first passing through a vibrating screen which effectively removes pieces of partially invested material. From the hopper, the sand is fed into one of two chambers. One of these is pressurized, while the other is at atmospheric pressure. The pressurized chamber feeds sand into the head at a rate commensurate with that at which sand can be discharged from the head. It is quite possible for cores or moulds to be blown in which the volume of sand required is greater than that stored in the head; this is achieved solely by ensuring the rapid filling of the head from the pressurized container. As this container is emptied, a transfer valve is operated, reversing the functions of the two pressure chambers. By this means the blow-head is constantly kept charged with the material. The second operator required on the unit is stationed at this point to control the sand system.

The whole unit is capable of a high production of both moulds and cores and it is interesting that both cores and moulds for the same component can be made at the same time. Apart from the operations of closing the moulds and pouring them, all other processes in the production of a casting are carried out with the machine. The fact that the moulds are produced by blowing the coated sand over a pattern plate should improve the density of packing of the moulds, eliminating the undesirable shadow effects which are so often prevalent in the dump box system of shell mould making. Indeed, the unit can, with some justification, be considered as an integrated foundry.

The precise temperature control of pattern equipment and accurately timed investments should certainly ensure the production of a range of cores and shell moulds under conditions approaching a closer uniformity than has to date been achieved.

Hydrostatic Extrusion

PRODUCTS with more uniform mechanical properties are obtainable by hydrostatic extrusion, and this process, developed by the D.S.I.R.'s National Engineering Laboratory, requires much lower pressures than the conventional process. Extrusion pressure is applied hydrostatically without any direct contact between ram and billet. Tests of the process have so far been restricted to pure aluminium and an aluminium alloy.

In the new process a cone is machined at one end of the billet so that it fits closely into a die with a conical entry. The die forms the exit from a cylindrical high-pressure chamber containing a liquid, such as glycerine, castor oil, or a dispersion of molybdenum disulphide in oil. The other end of the chamber is closed by the ram of a hydraulic press. As the ram moves into the chamber, pressure builds up in the liquid, which transmits the extrusion pressure to the billet. The material is extruded through the die without any direct contact between ram and billet. The fluid acts as an efficient lubricant and makes it possible to use conical-entry dies with very small die angles.

In addition, the nosing of the billet reduces the amount of work expended in deforming the metal and hence the maximum extrusion pressure required. Reductions in extrusion pressure of 30-40 per cent have been obtained in the laboratory tests. With pure aluminium, the maximum extrusion pressure for the production of rod at an extrusion ratio of 7, through a conical-entry die with a 20° included angle, was 17 tons/in^2, compared with a pressure of 32 tons/in^2 for a conventional extrusion through a square-entry die. With the alloy (0·7 per cent magnesium, 1 per cent silicon and 0·7 per cent manganese), the pressure was 29 tons/in^2 compared with 43 tons/in^2 by conventional methods. All these figures are for extrusion from an unheated billet. The distribution of hardness over the cross-section of the extruded rod was much more uniform than usual, and this will often be an important advantage. These results suggest that cold extrusion of high strength materials will be possible.

The Transall C.160, a tactical transport designed to operate from short airstrips

[Courtesy "Flight"

Large Die-Forged Propeller Blade

RECENTLY forged for the de Havilland Aircraft Company Limited, the biggest die-forged aluminium propeller blade yet made in Britain is to be used in the propeller equipment for three prototype Transall C.160 aircraft ordered for the French and German Air Forces.

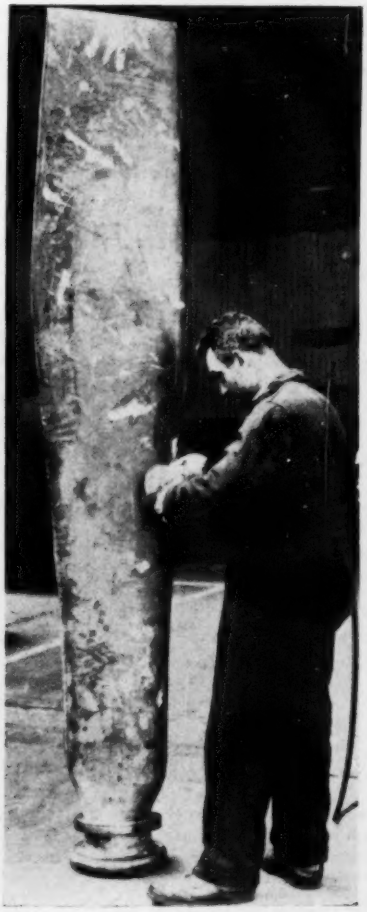
The de Havilland 4/8000/6-type propeller, with a diameter of 18 ft, was specially designed for the Rolls-Royce Tyne turbine engines of the Transall C.160, and is the result of six years' intensive design and development work on the Tyne turbine engine. The propeller hub, which incorporates the familiar features of Hydromatic design, also embodies a number of improvements necessitated by the characteristics of the Tyne turbine engine. The basic unit upon which the propeller is built, is the "spider"—a high-tensile steel forging accurately machined to fit the engine propeller shaft. The four aluminium alloy blades are retained on the arms of the "spider" by a high-tensile steel barrel of two-piece design, upon which the pitch-change mechanism is mounted.

The solid aluminium-alloy propeller blades, of double-taper plan form, are machined from forgings produced at the Handsworth (Birmingham) works of Alcan Industries Limited on their 45,000-lb. forging hammer.

The blades are made from extruded forging stock in Noral 17S alloy chosen for its special properties. As manufactured, the forging stock is cylindrical in form, 87 in. long, 8½ in. in diameter, and 500 lb. in weight. Prior to forging, the stock is scalped to a diameter of 7½ in. and one end is machined to provide a 7 in. long tong hold. The stock is then soaked in a pre-heat furnace and, having been brought up to a temperature of 450° C., at which point it is malleable, it receives the first of three part-stampings in the preparation dies of the forging hammer, alternated with intermediate preheats. The part-forged blade is closely inspected between each operation and the excess metal, or "flash", is removed. This preheat/part-stamp sequence continues with the finishing dies, after which the tong hold is removed and the hub

Right: After forging, small surface marks are removed with an abrasive

Below: Striking the Transall C.160 propeller blade in the 45,000 lb. forging hammer



machined. At this point, the blade measures 108 in. in length, with a maximum width of 19½ in. After a further soaking in the preheat furnace, the blade is placed in an upsetting press where the steel thrust rings are retained on the shank by an upset flange. The upsetting operation, which reduces the length of the blade to 105 in., is followed by solution heat-treatment (the metal ageing naturally at room temperature and reaching its maximum properties after about five days), trueing of the blade and ensuring a twist of 48½°, and finally polishing of the thrust rings. The weight of the blade on leaving the forge is 350 lb.

At the de Havilland Company's works at Stevenage, the blades are machined to a maximum width of 18·4 in., after which they are anodized.

Correspondence

Correspondence is invited on any subject considered to be of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents in these columns

Cable Sheathing — Sublimation of Metals — Titanium Carriers

TO THE EDITOR OF METAL INDUSTRY

SIR,—In the feature "Reviews of the Month" in your issue of the 25th August, your contributor, when reviewing the book "Lead and Lead Alloys for Cable Sheathing", by S. A. Hiscock, suggests that the contents of the book could be subdivided and published separately at a price that would make them available to the "lesser paid workers in the industry".

Mr. Hiscock is a member of the staff of my Association, and you will be interested to know that we have made arrangements for certain sections of the book to be issued as separate publications for a wide distribution throughout the cable-making industry, both at home and abroad.

Yours, etc.,

James Oldroyd,
General Manager.

Lead Development Association,
34 Berkeley Square,
London, W.1.

SIR,—In a recent article "Skimmer" referred to the sublimation of metals, in particular to the sublimation of lead-tin alloys.

He shattered me!

My old Prof. at Aberdeen left a lasting impression on my mind that sublimation meant the passage from the solid phase to the vapour phase without a liquid phase, but perhaps present-day usage has made my impression out of date?

"Skimmer's" articles still attract my first attention when METAL INDUSTRY appears on my desk.

Yours, etc.,

W. R. Cummins.

"Skimmer" comments:—"I am all in favour of observing definitions, in this case of sublimation as the passage of a substance directly from the solid phase to the vapour phase, but has anybody observed whether a metal specimen being exploded by the passage through it of a high-intensity electric discharge does in fact have time to melt before vaporizing."

SIR,—The successful use of titanium for carriers in hot dip galvanizing is already widely known. Tests have now been carried out to broaden operating know-how and your readers may be interested in the following summary of results:

(1) Carriers going into hydrochloric acid pickle, then into zinc ammonium chloride pre-flux and finally into molten zinc, have been put through some thousands of immersions on production plant and the complete absence of corrosion indicates a life expectation of many years. Care must, however, be taken with positioning and execution of welds. Category: excellent, recommended.

(2) There are grounds for expecting the same behaviour from carriers going into sulphuric acid pickle and then into pre-flux and molten zinc. Confirmatory long-term production tests of this process are awaited. Category: probably excellent, tests to be undertaken.

(3) Titanium is entirely unsuitable for tanks and other parts continuously in contact with molten zinc. Gross corrosion takes place within a matter of days. Category: not recommended.

(4) The behaviour of titanium immersed briefly but repeatedly in molten zinc, without intermediate pickling or pre-fluxing is under investigation and results will be available soon. In the meantime, the use of titanium is not recommended where it would be entering molten zinc repeatedly without intermediate pickling or pre-fluxing. Category: doubtful, under test.

Yours, etc.,

A. O. F. Freund,
Development Officer,
I.C.I. Metals Division.

Scrap Processing

A RANGE of hydraulically-operated shears and baling presses for scrap processing has been introduced to this country by Sheppard and Sons Limited, Bridgend, Glamorgan.

This equipment — the Scrapmaster range—has been developed by Harris Foundry and Machine Company of Cordele, Georgia, U.S.A., with whom Sheppard and Sons Limited have entered into a sole manufacturing and sales licensing agreement for the United Kingdom, Europe and elsewhere.

The equipment is characterized by rugged and essentially functional design, with fast, consistent operation, and with complete safety.

The hydraulic scrap shear range available is continually being extended but is based on two distinct types of machine: shears with the unique baler type charging box and, alternatively, shears equipped with a compression side type charging box. The baler type charging box enables scrap to be gathered together and compressed within the box as it closes into a high density load prior to shearing into lengths which can be pre-selected, all under absolute protection. Thus, scrap charges bigger than the charging box itself can be swiftly and economically processed, and this feature is common to the alternative compression side type of charging box.

Coupled with these features are shearing capacities from 300-2,000 tons force, capable of speedy processing of the lightest to the heaviest of scrap.

Features which are common to the shear and baler range include revolutionary cellular fabricated construction and simple hydraulic operation incorporating unique, fast-operating Harris patented valves. The work of the operator is reduced to a minimum with a remote control panel providing a choice of manual push-button control, semi-automatic or completely automatic operation.

OUT OF THE MELTING POT

Ledge Theory

THE generally accepted theory of recrystallization, according to which, dislocations in cold-worked metals polygonize to form sub-grains, and certain of these sub-grains then grow at the expense of others, dates back to 1950-1953. Considering its age, as theories go, and some of the criticism it has received in the interim period, it is certainly due for revision and probable replacement. A possible replacement recently suggested is the ledge theory of recrystallization in polycrystalline metals. According to this theory, when a polycrystalline metal specimen is deformed, ledges must be produced on grain boundaries in the interior of the specimen, corresponding to slip lines on the external surface, but much less pronounced. During recrystallization, grain boundary migration occurs as a result of a ledge tending to straighten out so as to reduce the total energy by decreasing the area of the grain boundary. If the volume swept by the migrating boundary remains stress free, and the height of the ledge is greater than a critical value dependent on the energy density in the deformed material, it can be shown that the grain boundary will continue to migrate until the nucleus of a new grain capable of indefinite growth has been produced. One deduction from the above ledge theory of recrystallization is that the temperature at which the metal is cold-worked could have an effect on the grain size of the recrystallized specimen. The lower the temperature at which the specimen is strained, the larger the number of slip lines, and the smaller the extent of the slip on each line. Thus the number of ledges of a given height should decrease as the temperature of straining is reduced. However, the energy density of the deformed material, for a given amount of strain, should be increased as the temperature is lowered, and the critical height of ledge will thereby be reduced. By measuring the energy density of the material just before recrystallization after deformation to a given strain at different temperatures, a quantitative check on the theory may thus be possible.

Yet More

EXTENSIVE investigations appear to have left very little to be added to the knowledge regarding the effect of impurities on the electrical conductivity of cast copper wirebars. This is largely confirmed by the results of a statistical analysis of data for wirebars produced over a period of five months of 1960 at two Russian works. Much of the article reporting the results is, in fact, devoted to a survey of earlier results obtained by other investigators with which the reported results are then found broadly to agree. Thus, on the assumption that the other factors (impurities) either remain constant or vary within limits such that their effect on the electrical conductivity is insignificant, the results of the statistical analysis indicated the previously observed reduction in specific resistance of copper with an increase in the concentration of lead and nickel, and its increase with the antimony content of the metal. The results also showed, in the case of metal from one of the two works, that the variation of the specific resistance with the oxygen content passed through a minimum (at 0·044 per cent oxygen), this behaviour being in accord with the dual function of oxygen in the metal, namely, as an impurity in its own right and as a scavenger for other impurities including, in particular, hydrogen. In connection with the latter, the results of the statistical analysis bring out the interesting fact of the existence of a definite seasonal variation of the specific resistance, which rises during the hotter months of the year to reach a well defined maximum in July, while falling to low values during the coldest months. This variation is readily traced to the corresponding variation of the mean relative humidity of the air, the significance of which is explained by the practice of blowing the melt with compressed atmospheric air during the oxidizing period of the melting process, in addition to the use of an oxidizing flame.

Rigid Test

WHEREAS for production control and other purposes the quality of spot welds is commonly evaluated by mechanical tests involving the failure of the spot welds in shear, considerable interest also attaches to the load-carrying ability of spot welds in tension. The tensile strength of a spot weld can be determined by forming the spot weld at the centre of the overlapping portions of two strips placed cross-wise over one another. After welding, the ends of the strips are bent up in opposite directions at right angles to the portion containing the weld. A tensile stress can then be transmitted to the spot weld through the upturned ends of the strips. In this method of testing, however, as well as in the very similar procedure in which the strips to be joined are placed parallel to one another instead of cross-wise, the lack of rigidity in the specimens, and in particular in the portion containing the spot weld, results in the stress applied to the weld not being a pure tensile stress, with the consequence that the weld may be expected to exhibit a lower load-carrying capacity. This has been confirmed by using a form of test-piece in which adequate rigidity is ensured. This test-piece is prepared by placing two tubular metal grips of appropriate diameter on either side of the spot welded joint, arranging the edges of the grips symmetrically around the spot weld to be tested, and then arc welding the edges of the grips to the surface of the weld specimen. The increased load-carrying capacity obtained with this rigid test-piece is shown, for example, by the results for 1·5+1·5 mm. thick specimens of aluminium-6 per cent magnesium alloy sheet, in which a 6-mm. diameter spot weld failed at a load of 167 kg. applied to a cross-shaped test-piece with upurned ends and at 221 kg. in the case of a test-piece with welded-on grips. Test-pieces of this type can also be used to determine the load-carrying capacity in tension of riveted connections.

Skimmer

MEN and Metals

Appointed European commercial representative for M and T Chemicals A.G., **Mr. Charles B. de Than** will be based in Zug, Switzerland, and will be responsible for contacts with European companies under licence to produce M and T inorganic and organometallic chemicals, organic coatings and electroplating chemicals.

Appointed as a director of Baker Perkins Ltd. is **Mr. W. S. B. Sampson.**

Recently retired from Samuel Fox and Company Limited, Sheffield, **Mr. Frank T. Bagnall** has made his services

available exclusively to Birlec-Efco (Melting) Limited. He will assist in the design and operation of all equipment manufactured by the company.

With a total of 99 years' service with Rowland Priest Limited, of Cradley Heath, **Mr. Sydney Brooks** and **Mr. Vernon Stanton Clifton** have retired from the company. Mr. Brooks has been in the machine shop for 52 years and Mr. Clifton, who joined the firm in 1914, had been foundry foreman for the past ten years. Each was presented with an inscribed gold watch by the firm's managing director, **Mr. R. J. Richardson.**

Retiring from his position with the Dowty Group, **Lt.-Gen. Sir John Evetts** will relinquish his directorship with Dowty Fuel Systems, and is to devote his time to the work of the Three Counties Industrial Education Association.

Appointed deputy director of engineering at The English Electric Company Limited, **Mr. Richard P. E. Tabb** will be mainly concerned with the company's technical development programmes.

Formerly with Jones Sewing Machines Limited, Stockport, where he held the post of general works manager, **Mr. M. Littlewood,** B.Sc., has been appointed by Metals and Alloys (Birmingham) Ltd. to the post of works manager. Also joining the company is **Mr. M. D. Love,** who becomes sales office manager, having previously held a similar post with S. Smith and Sons (England) Ltd., Birmingham.

Having left for America on September 7, **Mr. P. R. Scutt,** managing director of Tecalemit Limited, will return on the 20th. The object of his visit is to extend the company's business in the U.S.A. and to attend a board meeting of Imperial-Eastman Corporation of Illinois, of which company he is a director.

International Nickel Company (Mond) Limited have recently announced the following appointments: **Mr. D. Parry Davies** has been appointed a director of Mond Nickel (Retirement) Trustees Limited and is succeeded as comptroller of the International Nickel Company (Mond) Limited and Henry Wiggin and Company Limited by **Mr. L. C. H. Voss. Mr. C. W. R. Edwards** has been appointed secretary of The International Nickel Company (Mond) Limited and Henry Wiggin and Company Limited in succession to **Mr. E. Vaughan,** who remains a director of both companies.

Elected as the 326th Master Cutler, **Mr. Gerard Young,** J.P., is the chairman of Tempered Group Limited, which consists of six subsidiary companies. Mr. Young is a member of the Institute of Mechanical Engineers and one of the founder-members of the Coil Spring Federation.

News from the Marshall Refractories group of companies is that **Mr. J. R. Gledhill, Mr. D. Gregory** and **Mr. A. H. Thompson** have been appointed directors of Thomas Marshall and Company (Loxley).

News from the Head Wrightson organization is that **Mr. J. D. Eccles** has been appointed director and general manager of Head Wrightson Stockton Limited. **Mr. G. F. Taylor** has been appointed general manager of Head Wrightson Steel Foundries Limited, and **Mr. A. J. Long** has joined the Head Wrightson Export Company as general manager.

Metal Cleaners

THREE new additions to its existing range of metal cleaning products have been introduced by the Metal Industries Division of Diversey (U.K.) Limited, of 42/46 Weymouth Street, London, W.1.

Diversey No. 1107 is a modern electrocleaner formulated to eliminate smut problems. It is a granular, free-flowing material, non-dusting and non-caking. Readily soluble in warm water, it has a special blend of wetting agents which help it to penetrate and loosen contamination very rapidly; oils and greases are emulsified. It is stated that Diversey No. 1107 gives a controlled foam blanket, preventing caustic spray and the risk of hydrogen explosions. The product is recommended for use with all ferrous metals and with copper, brass and bronze. It can be used either cathodically or anodically. It is normally used at a working solution strength of 6-8 oz/gal. of water (25-100 amp/ft^2; 170-200° F.).

A new caustic soak-type paint stripper, Diverstrip G-20, is suitable for use on all metals except zinc and aluminium. The makers claim that it gives extremely rapid penetration of a very wide range of paint coatings. Paint films are quickly dissolved and the vehicles are rapidly emulsified and saponified. It is claimed that the free-rinsing qualities of the product ensure complete removal from treated surfaces. Laboratory tests, using the product at a concentration of 10 oz/gal. (200° F.), showed that single coatings of 16 widely different types of paint were removed in 15 minutes or less. G-20 is recommended for cleaning paint spray booth equipment. A granular, free-flowing compound, non-dusting and non-caking, it is readily soluble in water. It is used in water solutions at concentrations ranging from 10-20 oz/gal. of water at temperatures of from 200° F. to boiling point. An ordinary steel tank with steel heating coils may be employed.

The third of these metal cleaners, Diversey Vitrosol, is a heavy duty soak cleaner for ferrous metals. It is recommended for use as a pre-soak cleaner prior to electrocleaning with Diversey No. 1107 and it is also most suitable for use in either soak or barrel cleaning operations prior to assembly, painting, or other surface finishing. It is recommended for use in automatic plating lines with short cycle cleaning. It is not suitable for use on aluminium or soft metals. Diversey Vitrosol is described as a white, granular free-flowing compound, readily soluble in cold water; it is non-dusting and will not cake in normal storage conditions. It is normally used at a concentration of 6-8 oz/gal. of water (160°-190° F.), immersion time depending on degree of contamination to be removed.

Industrial News *Home and Overseas*

Extrusion Presses for Britain

Recent advances in engineering have led to a marked improvement in the design of hydraulic presses for processing light metal, heavy metal or steel billets to sections, bar stock, strip, wire, tubes and hollow sections. Modern control facilities and novel design features incorporated in presses and ancillary equipment have greatly helped to promote economic flow of production and to raise the quality level of products. The construction of five ultra-modern extrusion presses for metal works in England is only one of the great number of major projects handled at present by **Schloemann Aktiengesellschaft,** Düsseldorf.

Engineering and Building Centre

Now being converted into a comprehensive exhibition hall, the former Masonic Temple in Broad Street, Birmingham, will provide a centenary-year new headquarters for the Engineering and Building Centre, Birmingham.

The new centre is, in fact, a direct descendant from the city's Iron and Coal Exchange, which was founded in 1861 and flourished for 80 years. Its place was ultimately taken by the Birmingham Exchange and Engineering Centre in Stephenson Place, which is to remove and link with the building trade on the new project.

Almost everything from door knobs and bath taps to tool steels and turbines will be on show in the 37,000 ft^2 building, which will also provide facilities for special short-term exhibitions in two smaller halls.

In addition, there will be reading, writing and refreshment rooms, secretarial services, private lockers for exhibitors, lecture halls, projection equipment, a catalogue library and a full information service for visitors to discuss, without any obligation, any aspect of business, from finding work contracts to locating the manufacturer of specific items.

More than 10,000 enquiries a year are being handled at the Stephenson Place premises, and in excess of 4,000 serious enquiries have been received at recent overseas trades fairs in which the Centre has organized group displays.

Clad Strip for Semiconductors

Manufacturers of semiconductor devices are now able to obtain sample quantities of "Nilo K" strip clad on each side with 0·5 per cent gold-antimony from **Johnson, Matthey and Co. Limited,** 73-83 Hatton Garden, London, E.C.1. It is hoped that production quantities will be available early next year.

The strip is available in width between $\frac{3}{32}$ in. (2·4 mm.) and 2 in. (50·8 mm.), in thicknesses down to 0·005 in. (0·13 mm.). The thickness of cladding that can be supplied on each face is either 11·5 per cent or 18·75 per cent of the total thickness.

Course for Plant Engineers

A comprehensive refresher course for works and plant engineers is to be held in Scotland again this winter, at the Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow. The course, organized by **The Institution of Plant Engineers,** comprises 18 weekly lectures on Wednesday evenings, commencing November 1.

The fee for the course is 4 gn. and copies of the syllabus and full particulars may be obtained from the Secretary to the Refresher Course, 39 Elmbank Crescent, Glasgow, C.2 (telephone Glasgow Central 5181).

Reactor Information

A booklet describing the work of the Dounreay Experimental Reactor Establishment at Thurso, Caithness, has been published by the **United Kingdom Atomic Energy Authority.** Among other activities of the Establishment it deals with fuel element development and fabrication, chemical plants, uranium plants, chemical research, effluents and analytical chemistry.

Metal Powders

A new booklet entitled "Metal Powders" outlines the range of metal powders and some of their properties now available from **Powder Metallurgy Ltd.,** which is a subsidiary of **F. W Berk and Co. Ltd.,** and which functions as the sales organization for the non-ferrous metal powders manufactured by that company.

"Metal Powders" is available free of charge from Powder Metallurgy Ltd., Berk House, 8 Baker Street, London, W.1.

Fine Wire Weaving

A number of new wire weaving looms have recently been installed in the wire weaving department at the Greenwich works of **G. A. Harvey and Co. (London) Ltd.** One of the looms is specially designed for weaving very fine wire and on it may be woven fine wire mesh, down to 400 meshes per lineal inch, using wire of 0·0008 in. diameter, in stainless steel, phosphor bronze or brass.

Fine mesh is used extensively as filter cloth in the chemical, flour milling, printing and aircraft industries.

Czechoslovakian Show

Together with their associates, **Electronic Instruments Limited,** Richmond, Surrey, the **Cambridge Instrument Company Limited** are again showing a selection from the wide range of instruments manufactured by both companies, on their stand at BRNO International Trade Fair, which is being held from September 10-24, 1961. E.I.L. will show mainly *p*H recorders and indicators, and the Cambridge Company will exhibit instruments for measuring such widely differing phenomena as electrical quantities, temperature, gas in hydrogen-cooled alternators, dimensional changes in metallurgical specimens undergoing load tests, the strength of natural and synthetic fibres, and vibrations and deflections of rotating shafts or load-bearing structures.

Maintenance of Presses

A mobile service unit from **L. Schuler A.G.** is at present visiting this country and calling upon Schuler Press users for service checks of their equipment.

The service is available free of charge to Schuler customers, who may secure details of the itinerary on application to Schuler Presses Limited, P.O. Box 51, Banner Lane, Tile Hill, Coventry.

Export Orders

During recent weeks **The Bronx Engineering Co. Ltd.** has received orders

One of the new wire weaving looms installed by G. A. Harvey and Co. (London) Ltd.

totaling £90,000 from overseas. Stanko-import, Russia, has placed a £45,000 order for plate bending rolls. From Finland a £24,000 order has been received for two large tube straightening machines for copper tubes. Orders worth £14,000, also for tube straightening machines, have come from Czechoslovakia, and a similar order worth £7,000 from Switzerland.

New Address

As from September 18, **Haywood Foundries Limited** are moving from their Seaton Place headquarters and will operate from 48 Wharfdale Road, London, N.1. The new telephone number is Terminus 8058.

Royal Metal Trades Ball

The Midlands Area annual ball organized on behalf of the **Royal Metal Trades Pension and Benevolent Society** will be held in the Grosvenor Suite, Grand Hotel, Birmingham, on Thursday, October 12, 1961.

There are now 172 pensioners on the books of the society. Of these, eight are the direct responsibility of the Midlands Area Council, and in respect of whom pensions and grants amounting to some £533 were paid out through the local secretary during the past 12 months. During the year two pensioners died.

Calls on the funds continue to increase year by year. It is therefore hoped that on this occasion the proceeds of the event may achieve a new high level.

Music will be provided by Sydney Lipton with his Grosvenor House Ballroom Orchestra. The price of the tickets will remain at 30s. each and other arrangements will be as on previous occasions.

Tickets may be obtained from any member of the executive committee or from the local secretary, Mr. E. S. Tranter, 151-3 Edmund Street, Birmingham, 3. Central 3158 or 2036.

Early application for tickets and reserved tables is desirable as the number of each is limited.

Sheffield Office

A Sheffield office is being opened by **George Kent Limited** at Lloyds Bank Chambers, Earl Street, Sheffield, 1 (telephone Sheffield 77471-2).

The branch is under the supervision of Mr. H. E. Farrar, area manager, assisted by Mr. G. H. Sharp, senior sales engineer, and is able to provide technical and contracting facilities with the additional support of a district service engineer and team.

Plant Stock List

A new stock list, to be published at regular intervals, is announced by the Industrial Plant Department of **Thos. W. Ward Ltd.** The first issue is a 16-page booklet, fully illustrated, listing current holdings of boilers, tanks, pipes and tubes, air receivers, valves, scaffolding, ladders, etc., and it also gives details of the department's activities in specialized fabrication.

Forthcoming Event

At the Effluent and Water Treatment Exhibition, to be held in London at the end of next month, **Prodorite Limited** will be showing on Stands 26-7 examples of their activities, including the design, installation and commissioning of effluent treatment plant. This covers chemical engineering and acid proof construction of all types, including tanks, floors and drainage embodying a range of corrosion-resisting mastics and a new and improved range of cements manufactured by the company in this country under special licence from Farbwerke Hoechst A.G.

New Tube Works Site

For the long-term development of its manufacturing capacity, **Tube Investments Limited** has acquired a 280-acre site at Washington, Co. Durham. The decision to purchase has been taken after full consultation with the Board of Trade, the Local Authorities and the district officials of the trades unions concerned.

It is expected that preliminary site work will begin early in 1962 and that by 1965 some 750 men and women will be employed in the manufacture of steel tubing. The first factory will house a highly mechanized electric resistance welded tube mill incorporating many advanced engineering features. Subsequent factories will be erected in accordance with a development programme for the production of steel tubes and other TI products.

The ultimate labour force is expected to exceed 3,000.

Metal Spinners Take-Over

All the capital of Webshaw Manufacturing Company, pressworkers and metal spinners, has been acquired by **Bulpitts (Swan Brand)**.

Pneumatic Screwdrivers

Sole U.K. agents for Grasso air tools, made in Holland, **B. O. Morris Ltd.** now announce the introduction of a new line of screwdrivers and nutrunners, which are described in a recent catalogue. There are three straight grip models at 500, 900 and 1,500 r.p.m., having plastics sheathed bodies which insulate the operator's hands from the cold; a hanging loop is provided for seated bench working. These three tools drive up to $\frac{1}{4}$ in. screws and bolts, and No. 12 woodscrews.

There are five pistol grip models, at 400, 600, 800, 1,000 and 3,000 r.p.m.; these drive up to $\frac{5}{16}$ in. dia. screws and bolts, and No. 14 woodscrews. A nose shroud used with slotted bits in guide sleeves makes operation almost silent, which is important where banks of tools are in use in mass production shops. Phillips' bits are also available, and an adaptor to take $\frac{1}{4}$ in. square drive sockets for bolts, nuts, etc.

The torque setting is easily adjusted in the nose of the tools with a spanner and hexagon key, and three different torque springs are supplied with each tool to cover a wide range of torques for different applications. The trigger of the tools can be kept depressed whilst operating on a series of screws, since the action of pressing the nose of the tool on to the screw actuates the screwdriver, and when withdrawn the bit remains stationary and instantly ready for the next screw.

Forthcoming Meetings

September 19—Institute of Metal Finishing. London Branch. Northampton College of Technology, St. John Street, London, E.C.1. "Plating of Zinc-Based Die-Castings." J. Edwards. 6.15 p.m.

September 19—Institute of Metal Finishing. South-West Branch. Royal Hotel, Bristol. "Duplex Nickel Plating." J. W. Weaver. 7.30 p.m.

September 21 — Society of Instrument Technology. Grangemouth Section. Leapark Hotel, Grangemouth. "Theoretical Aspects of Control Engineering." J. M. Keating. 7 p.m.

September 21—Non-Destructive Testing Society of Great Britain. Blossoms Hotel, Chester. Three-day conference on Non-Destructive Testing.

Trade Luncheon

It is announced that the next trade luncheon of the **Gauge and Tool Makers' Association** will be held at the Savoy Hotel, London, at 12.15 for 1 p.m. on Tuesday, October 3 next. The guest of honour will be the Rt. Hon. Edward Heath, M.B.E., M.P., Lord Privy Seal, who will take as the subject of his address the European Common Market.

Rolling Mill Plant

A modern combined medium section and beam mill, having a monthly production capacity of 30,000 tons, is to be installed by Lorraine Escaut S.A. at their Longwy steel works. The plant is to be laid out for the rolling of rounds, squares, angles, channels, tees and parallel-flanged beams. It is scheduled for commissioning in mid-1963. **Schloemann Aktiengesellschaft,** Düsseldorf, have been awarded the contract for engineering the complete mill and they will be supplying a large part of the rolling mill equipment.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 102 tons to 5,526 tons, comprising London 2,415, Liverpool 1,755 and Hull 1,356 tons.

Copper stocks rose 170 tons to 21,884, distributed as follows: London 650, Liverpool 17,184, Birmingham 50, Manchester 3,925, Hull 50, and Glasgow 25.

Lead duty-free stocks fell 200 tons to 7,056 tons, comprising London 6,806, Glasgow 100 and Swansea 150. In-bond stocks rose 925 tons to 3,827 tons (all in London).

Zinc duty-free stocks rose 49 tons to 3,790, comprising London 2,646, Glasgow 76, Hull 425, Manchester 375, and Liverpool 268. In-bond stocks rose 425 tons to 3,284 (all in London).

Spanish Aluminium Plant

A new aluminium plant, Aluminio de Galicia S.A., has been officially inaugurated near La Coruna, according to a press report. Production is expected to increase in stages to 60,000 tons a year, some of which may possibly be for export, the report added.

Aluminium Pipeline System

An aluminium underground pipeline system for connecting gas mains to home lines, less expensive to install than anything now available, has been developed by Reynolds Metal Company. "The aluminium system eliminates the need for intermediate joints because it is fabricated in continuous 300 ft. coils or longer. This, plus the fact it is competitively priced to begin with, offers utilities an important new product", a company official said. "Coils in $\frac{1}{2}$ and $1\frac{1}{2}$ in. normal pipe sizes are now being produced at the company's Phoenix plant. The first shipment is scheduled for an eastern seaboard gas utility. While coils now are available on a test order basis, they will be offered

commercially within the next 90 days. This is a new use for aluminium, opening a market with an annual potential of about 3,000,000 lb.", he added.

Mr. Robert S. Dalrymple, the company's chief corrosion engineer, who developed the product, said "the aluminium pipe is protected on the outside with a vinyl-butyl rubber laminate. This, plus inexpensive insulating end joints, eliminates corrosion as a factor. As an added advantage, the smooth interior of the aluminium pipe increases flow efficiency by over eight per cent as compared to steel pipe", Mr. Dalrymple stated.

Malayan Tin

According to news from Kuala Lumpur, Malayan tin producing interests have expressed astonishment at the General Services Administration's second announcement last Friday that it had asked Congress to waive the six months' waiting period for disposal of 10,000 tons of the 50,000 long tons of excess pig tin from the national stockpile. In view of the recent approach to the U.S. authorities by the International Tin Council, mining companies were taken aback by the request being made prior to the pending I.T.C. meeting in London, and apparently without consultation.

Press criticism in Malaya on the move was followed on Monday by further adverse comment in the *Straits Times*. In the uncertain atmosphere prevailing, in metal and mining shares, markets fell back further. Singapore tin prices declined 3¼ dollars to 474¼ dollars a picul. Tin shares also showed numerous losses. Singapore sharebrokers said there was considerable selling pressure which was cushioned by buying from bargain hunters.

Share prices have generally returned to around the lows which followed last week's first G.S.A. announcement asking Congress for permission to release small quantities from the 50,000 tons of excess pig tin from time to time.

A Removal

Specialists in industrial hose and high pressure flexible pipes and fittings, **Singlehurst Engineering Ltd.** have moved to larger premises with greater facilities at 72-76 Clun Street, Sheffield, 4. The telephone number remains at Sheffield 29919.

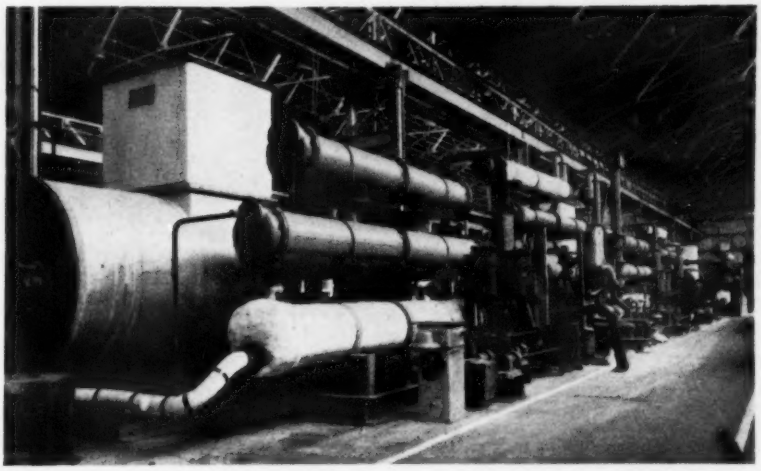
Showing at Czechoslovakia

At the International Trade Fair now being held at Brno, Czechoslovakia, **Morganite Exports Limited,** a member of the Morgan Crucible Group, is exhibiting a wide range of group products on Stand 108E in the gallery of Pavilion Z. Products on display include carbon components, resistors and potentiometers, "Purox" recrystallized alumina refractories, "Crusilite" electric furnace elements, "Suprex" crucibles and basins, and "Salamander" plumbago accessories, and "Foliac" colloidal graphite.

Research Section

An announcement from the **British Iron and Steel Research Association** states that in recognition of the steady growth in the scope of its activities over recent years, the Computer Applications Section of their operational research department has now been renamed the Systems Evaluation Section.

The duties of the new section, which will be headed by Mr. D. H. Kelley, B.Sc., will be to carry out operational research investigations into the automation of large scale systems. The immediate programme will be to study the automatic production planning and scheduling of various kinds of steelworks, and to investigate the information requirements of steelworks management.



This photograph shows a number of hydrogen/nitrogen plants in course of assembly in the Smethwick works of The Incandescent Heat Company Ltd., prior to despatch to overseas customers. They will be used in steel and chemical industries

Temperature Controller

On Stand No. 2 at the forthcoming Heating, Ventilating and Air Conditioning Exhibition at Olympia in London, the **Foster Instrument Company Limited** will be showing a new indicating temperature controller, fitted with the "Resilia" shockproof moving coil and magnet system. This instrument will be shown operating in an ambient temperature of 130° F.

The Type 3556 indicating controller incorporates a unique photo-sensitive control system which makes it possible for the instrument to operate continuously with a comfortable margin of safety, in an ambient temperature of 130° F.

I.T.C. Meeting

It has been announced that the next meeting of the **International Tin Council** has been fixed for Monday, October 9 next. The meeting was previously arranged for mid-September.

New Accommodation

News from **Optoshield Limited** is that they are now transferring all their production and development departments to more spacious accommodation at Watford to implement their extensive new development programme.

The sales department and head office remain at 146 Clerkenwell Road, London, E.C.1, and orders should continue to be sent there.

Birmingham Meeting

On Thursday, September 28 next, at the College of Advanced Technology, Birmingham, the first joint meeting of the Birmingham Metallurgical Society and the local section of the Institute of Metals will be held at 6.30 p.m. Prof. R. W. K. Honeycombe, Ph.D., M.Sc., F.I.M., of Sheffield University, will present a Paper on "The Origins of Strength in Alloys". Dr. I. G. Slater will be in the chair.

Chilean Copper Sales

It has been announced in New York that copper sales by ENAMI (Empressa Nacional de Mineria) for the account of small Chilean producers during the past week totalled 460 tons. Sales to Soellnes comprised 190 tons at 30·09, 100 tons at 30·03, and 100 tons at 29·96, while 50 tons were sold to Kloekner at 29·851.

Aluminium Press

According to the latest news from the U.S.A., the Watson-Stillman press division of the Farrel-Birmingham company has said it has built the largest aluminium rod and tube extrusion press of its kind in the world at its Blossom Road plant. The press, built for the Reynolds Metals Company plant in Richmond, Virginia, is 25 ft. high, 28 ft. wide, 220 ft. long, and weighs approximately 575 tons. It presses preheated aluminium billets through dies to form various extruded shapes 14 in. in diameter or width, and will increase monthly production at the Reynolds plant to more than 3,000,000 lb. of extruded products.

Efco News

The latest edition of the *Efco Journal*, issued by **Efco Furnaces Ltd.,** contains an interesting article on "Fuel-Fired Furnaces for Heating Prior to Hot Forming", by Kurt Genrich, and another by A. Knight on "Production Heat Treatment by High Frequency Induction". The journal also contains a description of the "Novexor" rotary filing machines.

Die Design

On Tuesday, October 3 next, a Symposium on Die Design, organized by the **Light Metal Founders' Association,** is to be held at the Queens Hotel, Birmingham, commencing at 10.45 a.m. The chair

will be taken by Mr. L. Fletcher, deputy chairman of the association, and the aim of the Symposium is to provide opportunity for discussion among members upon die problems and advances in design techniques.

Export Training

Stated to be the first of its kind in this country, an export training centre for Top Management has been opened at Sundridge Park, Kent. It has been set up by the existing Management Centre at Sundridge Park to help the country's export drive by providing comprehensive training facilities on a residential basis.

Starting on Monday last, three-week courses are to be held at the Centre at regular intervals. They have been planned in consultation with a special advisory panel set up for the purpose by the Federation of British Industries, and are intended for managing directors, export directors and all senior sales executives concerned with the promotion of export business. All the main factors affecting export policy and marketing procedures in present world conditions will be studied, and the principles and techniques discussed will apply equally to large and small organizations, irrespective of the type of product manufactured.

Subjects covered will include the selection of markets, the conducting of market surveys, appointment of selling agents, methods of determining prices, control of overseas sales forces and the most appropriate kind of advertising. Special attention will be paid to Common Market trading and selling to Communist countries.

Process Control

Isokinetic sampling apparatus designed to provide accurate and expeditious recording of dust, grit and fume emission from factory and other stacks is reported to have been successfully developed by **Visco Limited.** Marketed under the name V.I.S.A. (Visco Isokinetic Sampling Apparatus), the equipment is a production version of an advanced system based on principles issuing from recent investigations by the British Iron and Steel Research Association into atmospheric pollution: a subject now assuming increasing importance as more and more areas are scheduled as smokeless zones.

V.I.S.A. consists essentially of five linked units—sampling probe, filter unit, cooling coil, pump unit and instrument unit. In addition, a combined pitot tube and pyrometer is provided for measuring gas velocities and temperature.

One of its commendable advantages is the speed at which samples can be taken. For example, the filter may be easily changed within 30 seconds. Another attractive feature is the ease with which it can be used in confined spaces.

Birmingham News

Conditions in the metal-using industries in the Midlands show little change. Labour disputes are still harassing the motor trade, and it is threatened with fresh trouble amongst supplier firms. In spite of this, it is encouraging to find that a slight improvement has been achieved so far this year in output, although it is still below last year's level. There are indications, too, that exports are making a gradual improvement in the American market. The high rate of activity continues in the building industry and there is a good demand for metal castings, pressings and stampings.

In the iron and steel trade it is easy to obtain supplies of most grades of material, and it looks as if consumers are postponing new business until stocks have been reduced. Even with a reduced output, the supply of material is ample to meet all market needs. The constructional steel market is fairly active, and there is a moderate demand for heavy forgings for railway and shipbuilding work. Imports of semi-finished steel have been on a lower scale so far this year. Re-rollers could handle much more business in small bars and sections. Pressure for reinforcing rods and bars for building work is maintained.

Thames Crossing Conductor Accessories

Specially designed Noral conductor accessories — including armour rods, corona-bells, and dead-end terminations —have been developed for the 7,700 ft. long conductors for the River Thames Crossing, due to come into operation later this year. The crossing will consist of a main span of 4,500 ft., and two approach spans of 1,600 ft., and the smooth-surfaced conductor which, at 2·214 in., is of the largest diameter yet used, may under the worst conditions of wind and ice be subjected to a loading of some 40 tons.

The 6 ft. long dead-end fittings are similar to the usual 'Noralgrip' type, consisting of a steel forging to hold the steel core, and an aluminium sleeve to carry the current and also take some of the load.

Alcan Industries Limited, who designed the terminations, were responsible for their application and for this operation a portable 300-ton compressor was used. BICC were responsible for their positioning on the conductors, which had to be carried out to an accuracy of plus or minus one foot on the entire conductor length.

Metals in Building

Provision of information on architecture, building, engineering and surveying is one of the purposes of the **Manchester Building Centre,** whose first annual report has just been published. In addition to its information service it has facilities for lectures, trade demonstratons, film shows, and special exhibitions. It stages a permanent exhibition where visitors may see materials, finishes and appliances. Lunch time film shows during the year included "Zinc Roll Cap Roofing" and "Standing Seam Zinc Roofing", by Z.D.A.; "Aluminium on the Skyline" by A.D.A.; "The Titanium Pigment Story" by British Titan Products Ltd.; and "Painting to Plan" by I.C.I. Paints Division.

Trade Publications

Lead for Radiation Protection.—Associated Lead Manufacturers Limited, Clements House, 14 Gresham Street, London, E.C.2.

An important brochure under this heading makes available in concise form up-to-date information about the part which lead plays in the field of radiation protection. The brochure gives much technical information on the mechanical properties of lead, the forms of lead shielding bricks available, and some of the alternative methods of providing reactor shielding. A section is also devoted to a new material called "Densithene", which is now being produced by the company and which is a composite lead/polythene product of particular importance in dealing with neutron and gamma-ray shielding. A special section deals with the use of lead in X-ray work. A number of diagrams and illustrations are included.

Heavy Duty Air Cylinders.—Benton and Stone Ltd., Aston Brook Street, Birmingham, 6.

A new range of heavy-duty air cylinders which are complementary to this company's existing range of 4½ in. and 6 in. bore standard duty cylinders, are described in a new leaflet just issued. Included in the leaflet is an easy reference chart to find the cylinder required. Statistical details are also given.

Heat Treatment. — AEI-Birlec Limited, Tyburn Road, Erdington, Birmingham, 24.

A new leaflet describes the JFC Mk. II furnace for accurate heat-treatment at temperatures up to 700°C. This furnace is a general purpose batch type furnace of vertical cylindrical design. Charge baskets are used to contain the components, which are heated by a high velocity heated air flow. The furnace is supplied as a packaged unit ready for connection to the power supply. Illustrations, diagrams and statistics are included in the leaflet.

Salt Bath Furnaces. — Efco Furnaces Limited, Queens Road, Weybridge, Surrey.

A detailed description of this company's electrode salt bath furnaces is given in a new 8-page leaflet just issued. In addition, to the descriptive text are diagrams, statistics, and excellent photographs showing these furnaces in operation.

Protection and Surface Treatment.—Magnesium Elektron Limited, Clifton Junction, Manchester.

The need for surface protection of magnesium alloys depends entirely on the conditions of service, and where these are known to be non-corrosive no protection may be necessary. A useful brochure, issued by this company, deals with this subject in a series of chapters, including: protection in storage, painting, chemical and electrochemical protective treatments, chromating baths, miscellaneous finishing materials, the use of test samples in the control of baths and, finally, with a table of the more usual cleaning and chromating processes for magnesium base alloys.

Electric Lifting Magnets.—The General Electric Company Limited, Witton, Birmingham, 6.

A new brochure (P.1008) "Witton Kramer Electric Lifting Magnets", fully revised from an earlier one of the same title, is now available from the company. This 24-page publication includes the full technical details of the company's electric lifting magnets, together with descriptions of the associated control gear. It is profusely illustrated with drawings and photographs showing the construction of the magnets, and also includes pictures of the magnets in service.

Metal Market News

TIN occupied the centre of the stage last week in view of the dramatic announcement from the G.S.A. to the effect that they were requesting Congress to release some 50,000 short tons of tin from the strategic stockpile. This tonnage is deemed to be surplus to the total required and may, therefore, be disposed of. The General Services Administration, which is the body responsible for dealing with all stockpile material in the United States, has announced that if and when this tin is sold due regard will be had to the interests of producers, consumers and others. Initially, however, the effect of this announcement on the London market was to crash the price of cash tin by about £50 per ton as bull speculators rushed to sell at any level. There was probably also a certain amount of short selling by bear operators. On Wednesday last week, when this anouncement came out, three months' tin was down to £946 in the first ring, but the quotation recovered to close at £953. In the afternoon, some ground was lost, but a recovery followed on the Kerb. Second thoughts brought a considerable change of heart on Thursday when, in the afternoon, forward tin closed at £967. Consumers were undoubtedly attracted at the lower level but they probably did not buy a lot. Friday saw an easing off to £961 forward, and the week closed at £952 for cash and £961 three months.

The turnover was about 2,350 tons and on balance cash lost £42 and three months £34. At the beginning of the week L.M.E. stocks of tin were reported 73 tons lower at 5,628 tons. Copper stocks were reduced by 75 tons to 21,714 tons, while stocks of zinc were also lower, by 201 tons, at 6,600 tons. At 10,158 tons the reserves of lead were down by 250 tons. On the whole, it was a depressing week, if only because of the violent setback in the tin price, but, in fact, there was a drop in each of the metals, zinc continuing marked downward drift. There certainly seems to be too much zinc at the present time, and demand is not very good. It has even been reported that high grade quality has been delivered on the market and, if this is correct, would be available at the current L.M.E. quotation, which is, of course, for G.O.B. brands. Some 7,000 tons of zinc changed hands last week with a fall of £2 in cash to £73 10s. 0d. and in three months of £1 17s. 6d. to £74 10s. 0d. It is, perhaps, rather surprising that the contango does not widen further.

Lead, although 7s. 6d. and 10s. lower on balance, looked fairly steady on a turnover of 6,700 tons. At the close, cash stood at £64 5s. 0d. and forward at £65 17s. 6d. The Bureau advanced statistics show a fall of 4,600 tons in July consumption to 28,369 tons, while stocks were about 1,100 tons up at 633,671. Copper lost ground, especially the cash price, which closed £2 5s. 0d. down at £231 10s. 0d. Three months was £1 15s. 0d. down at £234 15s. 0d., and the turnover was 12,000 tons. Demand was unimpressive and the downward drift continued, Friday afternoon's market being depressed by the news that the Kennecott strike in the U.S.A. was over. It was also learnt that work was being resumed at El Salvador, Chuquicamata and El Teniente in Chile, this action obviously making a settlement of the "main" strike at Potrerillos much more likely. Bureau figures for July give consumption of copper at 54,556 tons, a drop of over 9,000 tons, while stocks in the U.K. dropped from 145,267 tons at June 30 to 142,962 tons at the end of July.

New York

Copper futures were little changed in price in slow dealings. In the physical market, custom smelters reported good sales at average prices, mostly for October. Large producers report good demand. In the outside market very quiet conditions prevailed. Scrap copper was quiet and prices remained unchanged. Lead and zinc were moderately active. Tin eased in price but activity was extremely small. There has been nothing fresh out of Washington on the General Service Administration disposal plan for 50,000 tons of tin. Trade sources point out that as yet there has been no legislation submitted to Congress to carry through the G.S.A. plan, and most feel that when a Bill is introduced it will take until the next session of Congress before anything is done about it.

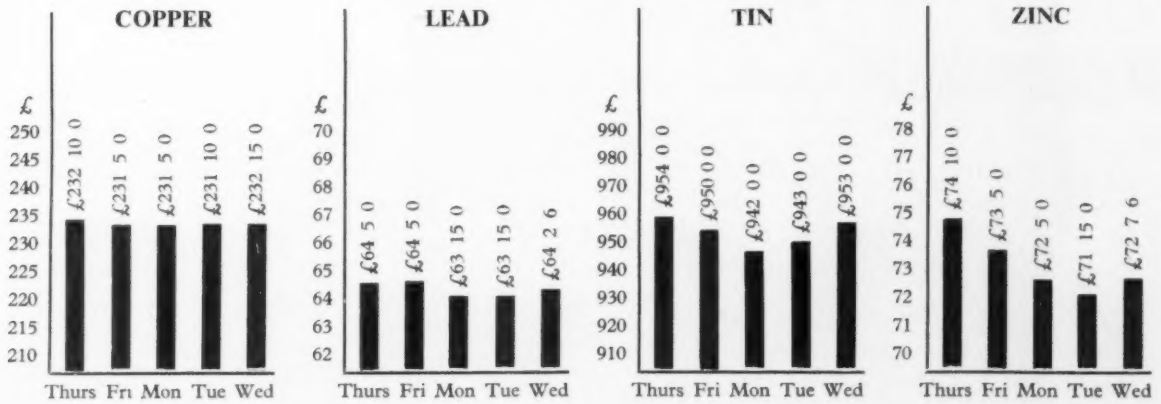
Revere Copper and Brass Incorporated has raised prices for the popular sizes of gauges of sheet copper by ¼ cent/lb. The price increase, effective from September 11, applies to popular sizes of 16, 20, 24, and 30 oz. copper sheets, roll and strip. A Revere spokesman said that the rise in prices for imported copper sheet was the reason for the increase. Meanwhile, spokesmen for other mills, said no action had yet been taken to make a similar increase.

Paris

A mixed trend developed on the Paris scrap market in the week ended on September 7. Despite the end of the summer holidays, activity was smaller as users showed only little disposition to trade, pending further developments on foreign markets. Prices of most copper products hardened as a result of firmness in raw copper abroad, but lead and zinc were easier on lack of interest.

London Metal Exchange

Thursday 7 September to Wednesday 13 September 1961



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NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 13/9/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	237	10	0
Antimony Metal 99%	„	230	0	0
Antimony Oxide Commercial	„	194	10	0
Antimony White Oxide	„	212	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	0
Calcium	„	2	0	0
Cerium 99%	„	15	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite per unit			8	0	0
Copper H.C. Electro	ton	232	15	0
Fire Refined 99·70%	„	231	0	0
Fire Refined 99·50%	„	230	0	0

		£	s.	d.
Copper Sulphate	ton	79	0	0
Germanium	grm.		—	
Gold	oz.	12	10	3
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	64	2	6
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		5	6
Alloy Ingot, AZ91X		1	11½-2	1½
Manganese Metal	ton	280	0	0
Mercury	flask	63	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	„		5	11
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	7¾
Tellurium Sticks	lb.	2	0	0
Tin	ton	953	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	72	14	4½
Dust 95/97%	„	118	10	0
Dust 98/99%	„	124	10	0
Granulated 99+%	„	97	14	4½
Granulated 99·99+%	„	110	6	3

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 13/9/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	210	0	0
B.S. 1490 L.M.6 „	202	0	0
B.S. 1490 L.M.7 „	216	0	0
B.S. 1490 L.M.8 „	203	0	0
B.S. 1490 L.M.9 „	203	0	0
B.S. 1490 L.M.10 „	221	0	0
B.S. 1490 L.M.11 „	215	0	0
B.S. 1490 L.M.12 „	223	0	0
B.S. 1490 L.M.13 „	216	0	0
B.S. 1490 L.M.14 „	224	0	0
B.S. 1490 L.M.15 „	210	0	0
B.S. 1490 L.M.16 „	206	0	0
B.S. 1490 L.M.18 „	203	0	0
B.S. 1490 L.M.22 „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 ton	152	0	0
B.S. 1490 L.M.2 „	152	0	0
B.S. 1490 L.M.4 „	161	0	0
B.S. 1490 L.M.6 „	176	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ton	243	0	0
BSS 1400 AB.2 „	251	0	0

***Brass**	£	s.	d.
BSS 1400-B3 65/35 ton	176	0	0
BSS 249 „		—	
BSS 1400-B6 85/15 „	222	0	0
***Gunmetal**			
R.C.H. 3/4% ton „		—	
(85/5/5/5) LG2 „	217	0	0
(86/7/5/2) LG3 „	227	0	0
(88/10/2/1) „	290	0	0
(88/10/2/½) „	300	0	0
***Manganese Bronze**			
BSS 1400 HTB1 „	194	0	0
BSS 1400 HTB2 „	213	0	0
BSS 1400 HTB3 „	229	0	0
Nickel Silver			
Casting Quality 12% „	265	0	0
„ „ 16% „	275	0	0
„ „ 18% „	320	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) „	317	0	0
B.S. 1400 L.P.B.1 „	241	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ton	258	0	0
15% „	261	0	0
Phosphor Tin			
5% „	1020	0	0
Silicon Bronze			
BSS 1400-SB1 „	280	0	0
Solder, soft, BSS 219			
Grade C Tinmans „	423	5	0
Grade D Plumbers „	335	5	0
Grade M „	467	5	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „		—	
Zinc Alloys			
BSS 1004 Alloy A ton	103	16	3
BSS 1004 Alloy B „	107	16	3
Sodium-Zinc lb.		2	6

SCRAP METALS

Merchants' average buying prices delivered, per ton, 12/9/61

Aluminium	£
New Cuttings	137
Old Rolled	103
Segregated Turnings	76
Brass	
Cuttings	160
Rod Ends	144
Heavy Yellow	137
Light	132
Rolled	147
Collected Scrap	134
Turnings	138

Copper	£
Wire	205
Firebox, cut up	203
Heavy	202
Light	200
Cuttings	210
Turnings	193
Braziery	166
Gunmetal	
Gear Wheels	200
Admiralty	200
Commercial	180
Turnings	175

Lead	£
Scrap	55
Nickel	
Cuttings	—
Anodes	590
Phosphor Bronze	
Scrap	180
Turnings	175
Zinc	
Remelted	67
Cuttings	58
Old Zinc	37

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

			£ s. d.
Aluminium			
Sheet	10 S.W.G.	lb.	2 10½
Sheet	18 S.W.G.	„	3 0½
Sheet	24 S.W.G.	„	3 3½
Strip	10 S.W.G.	„	2 10½
Strip	18 S.W.G.	„	2 11½
Strip	24 S.W.G.	„	3 1
Circles	22 S.W.G.	„	3 4½
Circles	18 S.W.G.	„	3 3½
Circles	12 S.W.G.	„	3 2½
Plate as rolled		„	2 10
Sections		„	3 4
Wire 10 S.W.G.		„	3 1½
Tubes 1 in. o.d. 16 S.W.G.		„	4 4
Aluminium Alloys			
BS 1470. HS19W.			
Sheet	10 S.W.G.	„	3 3
Sheet	18 S.W.G.	„	3 5½
Sheet	24 S.W.G.	„	4 1
Strip	10 S.W.G.	„	3 3
Strip	18 S.W.G.	„	3 4½
Strip	24 S.W.G.	„	4 0½
BS1477. HP30M.			
Plate as rolled		„	3 1
BS1470. HC15WP.			
Sheet	10 S.W.G.	„	4 3
Sheet	18 S.W.G.	„	4 8½
Sheet	24 S.W.G.	„	5 8½
Strip	10 S.W.G.	„	4 4
Strip	18 S.W.G.	„	4 8½
Strip	24 S.W.G.	„	5 4½

		£ s. d.
Aluminium Alloys—cont.		
BS1477. HPC15WP. Plate heat treated	lb.	3 10½
BS1475. HG19W. Wire 10 S.W.G.	„	4 2
BS1471. HT19WP. Tubes 1 in. o.d. 16 S.W.G.	„	5 5
BS1476. HE19WP. Sections	„	3 4
Split tube 19 S.W.G. (⅛″)	„	4 2
20 S.W.G. (⅜″)	„	3 11
21 S.W.G. (¼″)	„	4 1
22 S.W.G. (½″)	„	4 11
Welded tube 14 to 20 S.W.G. (sizes ½″ to 1½″)	„	3/10½ to 5/8½
Brass		
Tubes	lb.	1 10½
Brazed Tubes	„	3 2½
Drawn Strip Sections	„	3 2½
Sheet	ton	198 15 0
Strip	„	198 15 0
Extruded Bar	lb.	2 0⅜
Condenser Plate (Yellow Metal)	ton	188 0 0
Condenser Plate (Naval Brass)	„	202 0 0
Wire	lb.	2 8½

		£ s. d.
Beryllium Copper		
Strip	lb.	1 4 11
Rod	„	1 1 6
Wire	„	1 4 9
Copper		
Tubes	lb.	2 3⅞
Sheet	ton	268 5 0
Strip	„	268 5 0
H.C. Wire	„	285 5 0
Cupro Nickel		
Tubes 70/30	lb.	3 9
Lead		
Pipes (London)	ton	107 0 0
Sheet (London)	„	104 15 0
Tellurium Lead	„	£6 extra
Nickel Silver		
Sheet and Strip 10%	lb.	3 11½
Wire 10%	„	4 4½
Phosphor Bronze		
Wire	„	4 2½
Titanium (1,000 lb. lots)		
Billet 4½″ to 18″ dia.	lb.	47/- 48/-
Rod ½″ to 4″ dia.	„	85/- 53/-
Wire ·036″-232″ dia.	„	159/- 99/-
Strip ·001″ to ·048″	„	350/- 68/-
Sheet 8′ × 2′. 20 gauge	„	73/-
Tube, representative average gauge	„	198/-
Extrusions	„	90/-
Zinc		
Sheet	ton	110 2 6
Strip	„	nom.

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	32.50	237 11
Tin	137.15	1,002 9

Canada	c/lb	£/ton
Aluminium	26.00	210 12
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.25	1,200 17
Copper: electrolytic	3.28	242 8
Lead	.95	70 4
Nickel	9.00	665 2
Tin	14.00	1,034 12
Zinc: Thermic	1.11	82 0
Zinc: electrolytic	1.19	87 5
Scrap		
Copper: electrolytic	2.87	212 2
Heavy copper	2.87	212 2
No. 1 copper wire	2.75	203 4
Brass rod ends	2.10	155 3
Zinc castings	.92	67 18
Lead	.88	65 6
Aluminium	1.80	133 0

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	485	283 4
Copper: wire bars 99.9	450	262 16
Lead	165	96 8
Nickel	1,300	805 14
Tin	1,840	1,074 11
Zinc: electrolytic	181	105 15
Scrap		
Aluminium soft sheet clippings (new)	305	178 2
Lead, soft, first quality	137	80 0
Lead, battery plates	77	45 19
Copper, first grade	370	216 0
Bronze, commercial gunmetal	420	245 7
Brass: heavy	275	160 12
Brass: light	260	152 16
Brass, bar turnings	275	160 12
Old zinc	107	62 10

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.98	250 12
Lead	.80	67 5
Nickel	7.50	630 15
Tin	11.70	983 18
Zinc: High grade 99.99	1.03	86 12

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	289,000
Copper wire No. 1	268,000
Copper wire No. 2	260,000
Heavy copper	260,000
Light copper	237,000
Brass, new cuttings	197,000
Red brass scrap	217,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	225	205 0
Heavy copper	220	200 8
Light copper	190	173 1
Heavy brass	145	132 1
Light brass	110	100 5
Soft lead	50	45 11
Zinc	50	45 11
Used aluminium unsorted	75	68 6

United States	c/lb	£/ton
Aluminium	26.00	207 4
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	11.00	87 13
Nickel	81.25	647 11
Tin	123.50	984 5
Zinc: electrolytic	12.50	99 12

THE STOCK EXCHANGE

Markets Hesitant And Business Quiet

ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 11 SEPT. + RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	31/6 —3d.	11	9	6 19 9	33/9	26/3	35/-	26/6
400,000	2/-	Anti-Attrition Metal	1/3	NIL	4	NIL	1/3½	0/9	1/6	0/9
43,133,593	Stk. (£1)	Associated Electrical Industries ...	38/-	15	15	7 18 0	54/10½	35/-	67/3	39/3
3,895,963	1	Birfield	63/3 +1/9	10	15‡	3 3 3	78/9	45/-	51/3	29/-
4,795,000	1	Birmid Industries	75/6 —6d.	20	20D	5 6 0	103/-	71/3	74/9	56/-
8,445,516	Stk. (10/-)	Birmingham Small Arms	21/3 —6d.	17½QT	12½	5 9 9	36/10½	20/6	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5% ...	12/6	5	5	8 0 0	14/6	12/3	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/- —1/-	6	6	7 10 0	17/6	15/6	20/-	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	15/9	6	6	7 10 0	18/-	15/3	21/1½	17/7½
18,846,647	Stk. (£1)	British Insulated Callender's Cables	59/- +1/6	13½	13½	4 11 6	62/3	49/-	61/4½	47/-
7,670,837	5/-	British Oxygen Co. Ltd., Ord. ...	18/6 +4½d.	16D	16	2 17 9	23/4½	17/6	35/-	19/10½
1,200,000	Stk. (5/-)	Canning (W.) & Co.	15/9	15%	25 + *2½C‡	5 0 6	20/9	13/7½	19/9	13/7½
60,484	1/-	Carr (Chas.)	1/1½	NIL	12½	—	1/7½	10½d.	2/3	1/-
555,000	1	Clifford (Chas.) Ltd.	29/6	12	10	8 2 6	31/-	26/-	35/-	28/9
45,000	1	Ditto Cum. Pref. 6%	15/-	6	6	8 0 0	15/3	15/-	16/-	15/10½
1,166,000	Stk. (2/-)	Clifford Components V	8/3	25*2½C	25*2½C	6 1 3	10/1½	7/3	11/9	6/10½
300,000	2/-	Coley Metals	3/-	15	15	10 0 0	4/5½	3/-	5/-	3/4½
10,185,696	1	Cons. Zinc Corp.†	68/6 —1/-	20	15	5 16 0	81/6	63/-	80/9	59/6
5,399,056	1	Davy-Ashmore	140/6 +1/9	27½	22½	3 18 3	177/6	129/6	147/3	99/6
8,000,000	5/-	Delta Metal	20/10½	20	17½	4 15 9	27/7½	19/9	29/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	39/3	15	15	7 12 9	52/3	39/-	56/9	45/-
1,155,000	1	Evered & Co.	43/6	10	10 ϕB	4 12 0	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	29/6 —2/-	10	10	6 15 6	39/6	28/9	47/9	29/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	53/9 —1/3	25	20	4 13 0	65/-	42/9	52/6	40/-
937,500	5/-	Glacier Metal Co. Ltd.	18/3	15	13	4 2 3	21/1½	13/9	16/1½	11/1½
2,750,000	5/-	Glynwed Tubes	24/6 —6d.	22½	25¶	4 11 9	30/3	23/-	27/6	17/-
7,228,065	10/-	Goodlass Wall & Lead Industries ...	33/6	15	19L	4 9 6	44/9	32/6	41/9	33/-
696,780	10/-	Greenwood & Batley	17/- —1/-	15	30‡	8 16 6	29/6	16/3	33/6	29/1½
792,000	5/-	Harrison (B'ham) Ord.	9/-	*10	*20‡	5 11 0	14/6	9/-	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	18/- —1/9	7	7	7 15 6	20/4½	19/7½	23/6	22/-
1,612,750	5/-	Heenan Group	13/-	13	15	5 0 0	17/1½	10/6	13/-	9/10½
251,689,407	Stk. (£1)	Imperial Chemical Industries ...	67/6 —3d.	13½	11½	4 1 6	81/6	63/1½	76/6	54/-
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/6 +3d.	5	5	6 18 0	16/-	13/10½	18/-	15/4½
29,196,118	**	International Nickel	148	$1.60	$1.50	1 16 6	160	104	105	84‡
6,000,000	1	Johnson, Matthey & Co.	71/6	15	12	4 5 0	75/-	57/6	67/6	44/9
600,000	10/-	Keith, Blackman	17/6	17½	17½E	10 0 0	21/6	16/6	32/6	17/6
320,000	4/-	London Aluminium	11/9	13	12	4 8 6	15/-	8/6	12/6	7/10½
1,530,024	1	McKechnie Bros. A Ord.	33/9 —1/3	12½K	17½F	7 8 3	53/3	33/9	69/3	55/-
1,108,268	5/-	Manganese Bronze & Brass	13/6	20%	20%	7 14 3	18/6	12/4½	18/6	13/4½
50,628	6/-	Ditto (7½% N.C. Pref.)	5/6	7½	7½	8 3 6	6/-	5/-	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	82/9 +9d.	12	12M	2 18 0	103/9	68/3	84/3	61/-
415,760	Stk. (2/-)	Metal Traders	7/6	50	50	3 6 9	8/9	6/9	10/9	7/1½
160,000	1	Mint (The) Birmingham	33/9	15G	12½	5 18 3	35/9	24/-	39/-	33/6
80,000	5	Ditto Pref. 6%	71/6	6	6	8 7 9	77/6	71/6	80/-	75/-
274,152	1/-	Minworth Metals	5/6	30	30S	5 9 0	6/3	4/6½	5/2½	3/10½
5,187,938	Stk. (£1)	Morgan Crucible A	58/9 +9d.	14	13	4 15 3	71/3	53/4½	63/-	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	14/-	5½	5½	7 17 3	17/-	13/10½	18/9	15/9
3,850,000	Stk. (£1)	Murex	40/- —1/6	13	22½J	6 10 0	52/-	39/9	45/-	35/3
585,000	5/-	Ratcliffs (Great Bridge) Ord. ...	16/3	10	10R	3 1 6	16/6	15/9	17/-	14/9
1,064,880	10/-	Sanderson Kayser	33/-	17½	35‡	5 6 0	41/3	29/-	40/3	27/7½
3,400,500	Stk. (5/-)	Serck	15/3	12½	17½GD	4 2 0	19/3	14/9	25/6	15/3
212,384	5/-	Stedall & Co.	7/9	15	15	9 13 6	10/3	7/6	10/3	6/3
8,035,372	Stk. (£1)	Stone-Platt Industries	54/-	16	15	5 18 6	67/-	50/-	64/4½	52/3
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	14/-	5½	5½	7 17 3	18/-	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	62/-	14	20	4 10 0	85/6	61/7½	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	32/9	10	10	6 2 3	38/3	29/-	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/- —3d.	5	5	7 13 9	15/-	12/4½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	18/9	*5	*5	7 18 9A	21/1½	18/3	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord.	72/6	13‡	25	3 15 6	84/6	64/6	94/-	63/-
7,109,424	Stk. (£1)	Westinghouse Brake	33/- +9d.	11	10	6 13 3	46/3	32/-	60/6	37/6
323,773	2/-	Wolverhampton Die-Casting ...	8/6	35	30	8 4 9	13/4½	8/3	13/10½	8/1½
591,000	5/-	Wolverhampton Metal	22/4½ +3d.	32½	32½	7 5 3	30/-	21/3	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	4/4½	15	20‡	8 11 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	13/1½	6	6	9 2 9	13/7½	13/-	15/-	13/6
150,000	1/-	Zinc Alloy Rust Proof	4/4½ +1½d.	40	30	9 2 9	5/6	4/3	5/4½	4/-

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. *The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. ϕ and 6¼% from Capital Profits. B and 50% capitalized issue. G and 50% capitalized issue. F and special 5% tax free dividend and 50% capitalized issue. ¶and 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. Q also 1/- special tax free dividend and 50% capitalized issue. T Per £1 unit. K Forecast dividend. § and 50% capitalized issue. V incorporating Clifford Covering.

The Thomas Bolton Capital has been acquired by British Insulated Callender's Cables.

Classified Advertisements

AGENCIES

MIDLANDS Firm with spare warehouse capacity anxious develop Non-Ferrous "Semis" Stockist department (including aluminium) would welcome application in strictest confidence from experienced Trader; highest capabilities and standing only considered. Remuneration in accordance with capabilities and results. Box 4385, c/o Metal Industry. [8433

CAPACITY AVAILABLE

SURFACE Finishing of Contoured Parts. Internal and External, up to 12" dia. and 18" long. Elliptical, Square, Rectangular, Hexagonal, Octagonal, etc.

ARMYTAGE BROS. (KNOTTINGLEY) Ltd., Foundry Lane, Knottingley, Yorkshire. Telephone Knottingley 2743-4. [0001

KELLERING and Cam Profiling Capacity up to 8 ft×6 ft., or 6 ft. diameter.

ARMYTAGE BROS. (KNOTTINGLEY) Ltd. The Foundry, Knottingley, Yorkshire. Tel. Knottingley 2743-4. [8364

SHEET Metal Fabrications of precision and repetitive nature a speciality. Wades (Halifax) Ltd., Arden Works, Fenton Road, Halifax. [0020

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A.R.B.—D.G.I. APPROVED
ELECTRO HEAT TREATMENTS LTD.
BULL LANE, WEST BROMWICH, STAFFS.
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BRIGHT Annealing. Bright Hardening. Case Hardening. Carbo Nitriding; Gas Carburizing; High Frequency.
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CONTROLLED atmospheres for all treatments, including hardening, annealing and tempering of ferrous and non-ferrous alloys.
LABORATORY SUPERVISION.
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99·99+% PURITY ZINC
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METAL COMPANY LIMITED
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PATENTS

THE Proprietors of Patent No. 796389, for "Improvements in or relating to Method of Making Composite Metal Bodies of Different Metals", desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to Haseltine Lake & Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2. [8426

SCRAP METAL (SALE & WANTED)

URGENTLY REQUIRED
ZINC BASE ALLOY SCRAP
clean or contaminated
TURNINGS AND SKIMMINGS
MITCHAM SMELTERS LTD.
REDHOUSE ROAD,
MITCHAM ROAD,
CROYDON, SURREY. [0008

NICKEL and High Nickel Content Scrap wanted. "Nimonics", "Inconel" "Monel", etc. Offer for best prices to Nicholson & Rhodes Ltd., Princess St., Sheffield, 4. Phone 27491. [0011

B. J. PERRY & CO. LTD.
Exchange Buildings, Birmingham, 2
for Phosphor Bronze Swarf and Scrap
and all Non-Ferrous Metals.
Tel.: Midland 5986-7. [0113

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Appointments and Situations

MORGANITE CRUCIBLE LIMITED

(A Member of The Morgan Crucible Group)

WANT:

A SENIOR DRAUGHTSMAN

to fill a senior position designing furnaces and furnace components for a new department at our Norton Works.

The post will appeal to those aged 27 and over who hold H.N.C. (Mechanical Engineering) and now seek promotion. Proven ability to stress materials is essential; experience of refractories and the problems of combustion and heat transfer will be a great advantage.

The post commands a four-figure salary and there are good prospects for advancement within the Group, which is expanding and has a comprehensive Pension Scheme.

Applications, giving details of career, quoting reference NF 2/61, can be sent in confidence to:

The Staff Manager
Morganite Crucible Limited
Norton Works
Norton, Worcester

HOOVER LIMITED

LABORATORY ASSISTANT (MALE)

THE Company has a vacancy for a Laboratory Assistant in its Metallurgical Laboratory for interesting work connected with materials used in the construction of Domestic Appliances.

APPLICANTS should offer some previous experience in a Metallurgical Laboratory and preference will be given to those studying for L.I.M.

GOOD Salary plus bonus payable.

APPLY in writing, stating age, qualifications and experience to

EMPLOYMENT OFFICER,

HOOVER LIMITED,

PERIVALE, GREENFORD, MIDDLESEX.

BICC

Have a vacancy in their Shepherds Bush Research Laboratories for:

SENIOR RESEARCH METALLURGIST

with experience in research or production to lead a section working on long and short term basic studies concerned with the processing of metals. The projects include wire drawing, welding and extrusion of cable, nickel, aluminium and lead materials.

The laboratories are modern and well equipped.

Applications giving details of qualifications and experience should be made to:

Personnel Officer:
BRITISH INSULATED CALLENDER'S CABLES LIMITED 38 WOOD LANE, W.12

PRODUCTION Manager required for Foundry in N.W. London, the essential requirements being age limit 30-40, an engineering background and ability to plan production. Some knowledge of time and motion study an advantage. This appointment provides scope for man with energy, drive and initiative. When replying please give brief details of education, experience and salary required. Our own staff have been informed of this advertisement. Box 4382, c/o Metal Industry. [8427

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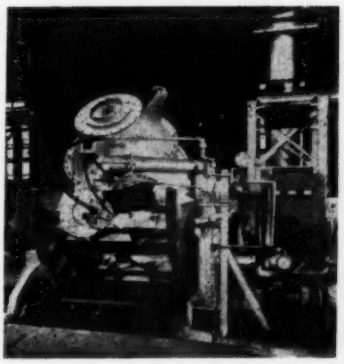

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